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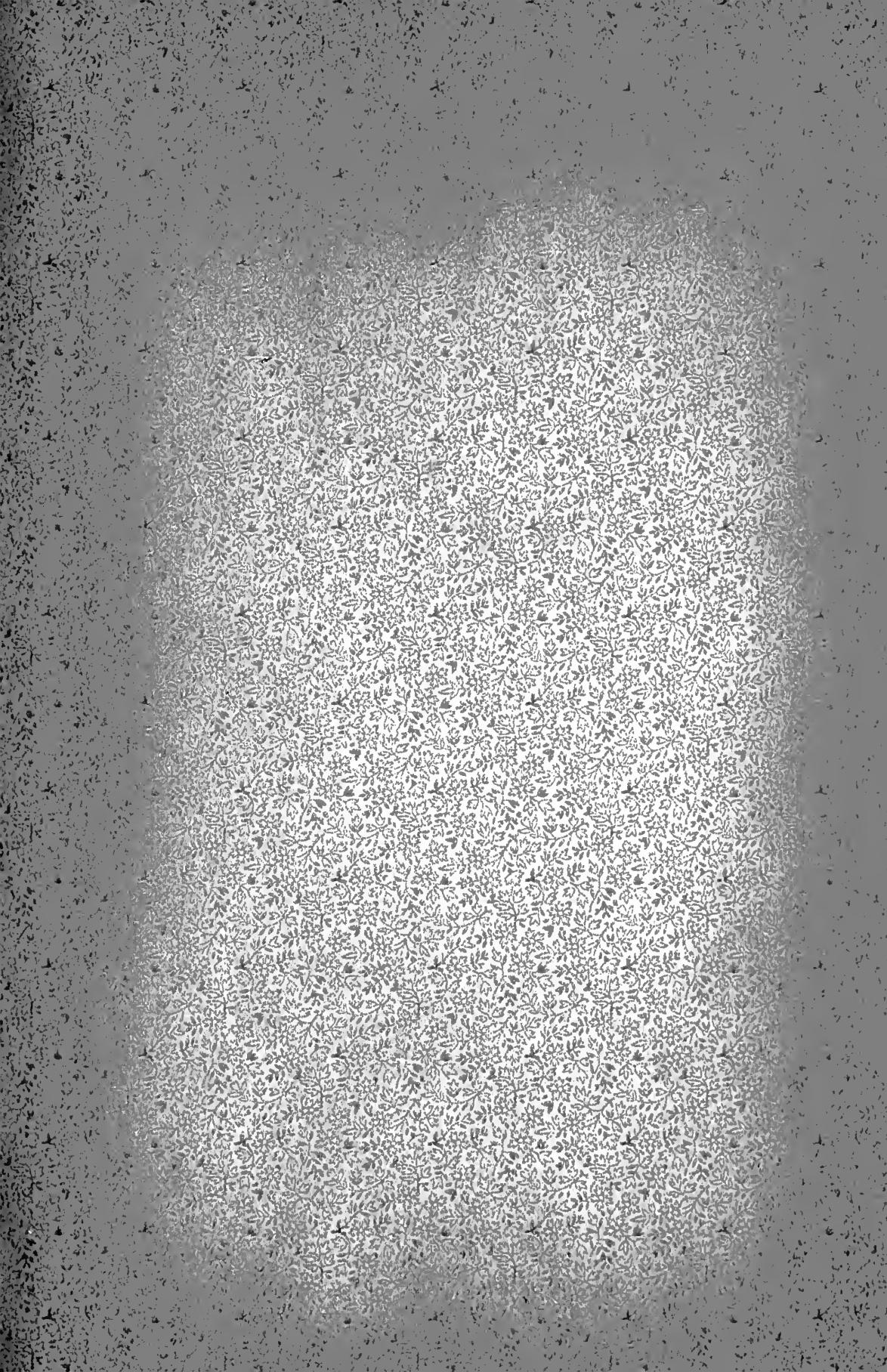
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OPERATIONS ON 459 CASES OF HERNIA IN THE JOHNS HOPKINS HOSPITAL FROM JUNE, 1889, TO JANUARY, 1899. THE SPECIAL CONSIDERATION OF 268 CASES OPERATED ON BY THE HALSTED METHOD, AND THE TRANSPLANTATION OF THE RECTUS MUSCLE IN CERTAIN CASES OF INGUINAL HERNIA IN WHICH THE CONJOINED TENDON IS OBLITERATED.

By JOS. C. BLOODGOOD,

Associate in Surgery, Johns Hopkins University, and late Resident Surgeon,  
The Johns Hopkins Hospital.

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INTRODUCTION.

In the Bulletin of the Johns Hopkins Hospital, vol. i, No. 1, December, 1889,<sup>1</sup> Dr. Halsted's operation for the cure of inguinal hernia in the male is first described. Inasmuch as Dr. Halsted's operation is supposed by many to be very much like that devised by Bassini, I wish to call attention to the fact that Bassini's first article on the subject did not appear until the following year.<sup>2</sup>

The first operation for inguinal hernia after the method first described by Dr. Halsted was performed a few days after the Johns Hopkins Hospital opened in June, 1889, since which time there have followed 268 operations for inguinal hernia in the male after this method. The date of the last operation recorded in this paper is December, 1898, the work having extended over a period of nine years and six months.

The ultimate results and the healing of the wounds have been made complete up to June 1, 1899, increasing the period of observation to ten years.

In the Johns Hopkins Bulletin, vol. iii, No. 23, June, 1892,

<sup>1</sup> In Dennis' System of Surgery, vol. iv, page 185, Doctors Bull and Coley give the reference to Halsted's first publication incorrectly, viz., To the Johns Hopkins Bulletin, 1893.

<sup>2</sup> Archiv für klin. Chir., Bd. 40, 429, 1890.

Dr. Halsted presented a number of cases of hernia, illustrating a modification of his operation, which consisted of the ligation and excision of the larger bundle of veins which accompanied the *vas deferens*. He believed that some or most of the veins may be superfluous, and accordingly excised all but the smaller bundle. By this procedure the cord may be reduced to less than one-fourth of its original size. He stated at that time that the object of the excision of the veins was to reduce the size of the cord, as it was reasonable to suppose that the size of the cord may influence the tendency of the hernia to return. The ultimate results have confirmed this belief.

The first case in which the modification was practised was Case 27, Group I, operated upon in August, 1891. But it was not until about January, 1892, that the excision of the veins began to be practised as a routine procedure in the operation for hernia. It was very soon discovered, however, that in those cases in which the veins were excised, swelling of the testicle after the operation was very likely to take place, and in some few cases in which the swelling of the testicle and epididymis was very marked, atrophy of the testicle resulted; for this reason the excision of the veins in operations for hernia has been discontinued as a routine practice and is now reserved for special cases.

In the Johns Hopkins Bulletin, vol. v, No. 42, October, 1894, Dr. Halsted reported on the substitution of silver wire for silk as a suture material for hernia and other laparotomy wounds. Silver was substituted for silk not because of its strength, but because of its germicidal properties, demonstrated by laboratory experiments by Dr. Parsons and by Dr. Bolton.<sup>1</sup>

Before Dr. Bolton's work, Dr. Parsons (assistant resident surgeon), at the suggestion of Dr. Halsted, had undertaken a series of experiments which demonstrated conclusively the germicidal powers of brass, copper and silver. Both brass and copper were proved to possess greater germicidal properties than silver, but we found on using the brass and copper in foil and wire that they were apt to produce necrosis of the tissues; for this reason silver was substituted.

Gold foil as a protective covering for wounds was employed be-

<sup>1</sup> Bolton, Transactions of Assoc. of Amer. Physicians, vol. ix (1894), p. 174.

fore the silver foil, but it was shown by laboratory experiments that gold had no germicidal properties. Copper and brass foil were then used in a few cases, but it was found that both not only produced tissue-necrosis, but were also dissolved by the secretions from the wound; and in one case there were symptoms of copper poisoning. For these reasons silver wire and silver foil were employed, although the germicidal properties of silver were recognized as being not so great as those of the other metals. Clinically the results in the healing of the wounds have been much better since the introduction of silver wire and silver foil. Before the introduction of silver wire 116 cases of hernia had been closed with silk; in 28 of these cases (24 per cent) there was more or less suppuration. Since silver wire was first used (June 2, 1894, Case No. 74, Group I) there have been 330 operations with 14 suppurations (4.2 per cent).

Since the wearing of rubber gloves in hernia operations by both operator and assistants, in February, 1897 (over two years), there have been 226 cases of hernia (including recent cases) with only four suppurations (1.8 per cent).

In this report, besides 268 cases in which the typical Halsted operation has been performed, are included all of the operations for hernia of various kinds which have been done since the opening of the Hospital, June, 1889, up to the present date, January, 1899, a period of 9 yrs. and 6 mos. Mention will be made of a new method of operation for varicocele, castration and hydrocele, in which the incision is made in the groin in the same way as that for hernia; this method was suggested by the excision of veins in the operation for hernia.

I have also included in this report a description of my method of transplantation of the rectus muscle in certain cases of hernia in which the palpable portion of the conjoined tendon is obliterated<sup>1</sup> (see Sec. IX).

The first operation at which the rectus muscle was transplanted was performed by me in April, 1897, two years ago. Since that time the rectus muscle has been transplanted in 53 operations; in

<sup>1</sup> Read at the 100th Annual Meeting of the Medical and Chirurgical Faculty of Maryland, Baltimore, April 28, 1898. Published, Maryland Medical Journal, May 7, 1898, and The Johns Hopkins Hospital Bulletin, vol. ix, No. 86, May, 1898.

21 cases because the conjoined tendon was obliterated, very narrow or relaxed.

In May, 1890, Doctor Halsted performed his operation without the transplantation of the cord or the excision of the veins. Up to February, 1896, this method was followed in 7 cases (Group II, Cases 1 to 7). In February, 1896 (Group II, Case 8), the veins were excised but the remainder of the cord (which had been torn from its bed in the inguinal canal) was not transplanted. Atrophy of the testicle followed in this case.

In January, 1897, I advised and tried the method of excision of the veins without disturbing the remainder of the cord (as in the operation for varicocele). The wound was closed in the usual way (Group II, Case 10).

Since that time this method has been followed in 6 cases. In 3 the rectus muscle was transplanted. During this period the same method has been followed in 20 cases; except that the veins (which were not large) were not excised. The rectus muscle was transplanted in 6 cases. In these 26 cases we have not observed a recurrence nor an atrophy of the testicle.

In October, 1898, I advised and tried the method of the splitting of the cord, transplanting the veins only, leaving the remainder of the cord undisturbed. This method should be followed when it is contra-indicated to excise the veins. (See page 286.) If the bundle of veins to be transplanted is unusually large, some of them should be ligated and excised. This method has been followed in 26 cases. In 13 cases the rectus muscle was transplanted. We have not observed a recurrence of the hernia nor an atrophy of the testicle.

Atrophy of the testicle has not been observed since September, 1896 (see Group I, Case 150). Since this date we have excised the veins, after the method described in this article (page 237), in 69 cases. Following the former method of excision of the veins we have observed 10 atrophies in 61 cases (see page 347).

Doctor Cushing (August, 1898) introduced the use of cocaine as a local anaesthetic in the operation for strangulated hernia and in non-strangulated hernia in which there were contra-indications to the general anaesthetic. Nineteen cases of hernia have so far been operated on with cocaine anaesthesia. The results have been most gratifying. (See page 337.)

In the study of the ultimate results we have been impressed with two causes of the recurrence of the hernia; the obliteration of the conjoined tendon; the cause of a recurrence in the lower angle of the wound and the presence of the transplanted cord in the upper angle of the wound in cases in which the cord was transplanted *in toto* without the excision of the veins.

The conjoined tendon has been found to be obliterated in 7 per cent of cases (366 cases, 27 with conjoined tendon obliterated). In 12 cases in which the conjoined tendon was obliterated a recurrence in the lower angle of the wound has taken place in 7 (over 50 per cent). These observations lead to the transplantation of the rectus muscle to strengthen the lower portion of the wound. So far this has been done in 21 cases. 14 cases have been observed from 6 months to 2 years. The results are perfect. (The remaining 7 cases are recent and not included in this paper.)

In cases in which the cord has been transplanted after the excision of the veins, there has been no recurrence nor weakness in the upper angle of the wound (109 cases). But in the cases in which the entire cord has been transplanted we have observed 7 small recurrences in the upper angle of the wound (6.4 per cent). Four have been subjected to operation the second time. In each case the small sac was situated above and accompanied a large bundle of veins through the abdominal wall.

In view of these observations, we have either excised the veins or transplanted the veins only (splitting the cord), and have left the remainder of the cord, a very small affair, undisturbed in its bed in the inguinal canal. Should the result in these cases be as perfect as in those cases in which the remainder of the cord, after the excision of the veins, has been transplanted, this method should be used because there is less danger of an epididymitis and atrophy of the testicle when the vas deferens and its immediate vessels are not torn from their bed in the inguinal canal. (See page 353.)

It should be recorded in justice to the correctness of our statistics that we have used every available means to ferret out the ultimate result in every case operated on for hernia since the Hospital opened in May, 1889. Not one case has been excluded from these records.

The hospital authorities have been very generous in meeting the expense of correspondence with all these cases; which has been done at least twice a year for six years.

This article has been delayed in order that it might represent ten years' observation from June, 1889, to June, 1899.

I wish also to record my most sincere thanks to Prof. Halsted for the great opportunity this work has given me to study the anatomy and operative treatment of hernia.

TABLE I.—*Number of Cases of Hernia. Classification according to Variety.<sup>1</sup>*

Inguinal	405 cases	Males	366	Females	39
Umbilical and ventral	24 " "	"	7	"	17
Femoral	30 "	"	11	"	19
—	—	—	—	—	—
Grand total	459		384		75

NON-STRANGULATED HERNIA.

Inguinal	362 cases	Males	325	Females	37
Umbilical and ventral	20 "	"	5	"	15
Femoral	13 "	"	4	"	9
—	—	—	—	—	—
Total	395		334		61

STRANGULATED HERNIA; CONTENTS OF SAC IN GOOD CONDITION.

Inguinal	33 cases	Males	31	Females	2
Umbilical	3 "	"	2	"	1
Femoral	12 "	"	5	"	7
—	—	—	—	—	—
Total	48		38		10

STRANGULATED HERNIA; CONTENTS OF SAC GANGRENOUS OR GENERAL PERITONITIS PRESENT.

Inguinal	10 cases	Males	10	Females	0
Umbilical	1 "	"	0	"	1
Femoral	5 "	"	2	"	3
—	—	—	—	—	—
Total	16		12		4

<sup>1</sup> Cases not operated on are not included.

TABLE II.—*Variety of Operation.*

## RADICAL OPERATION.

Inguinal hernia, 394 operations. June, 1889, to January, 1899.

Group	I.	Halsted's operation, cord transplanted	268 times.
I (A).	Veins only transplanted	2	
	II. Cord not transplanted	25	
	III. Cord excised	20	
	IV. Castration	27	
	V. Female	39	
	VI. McBurney's operation	7	
VII.	Testicle replaced in the abdominal cavity (Cushing)	4	
VIII.	Bassini's operation	2	
IX.	Ventral hernia (22 operations).		
	Umbilical	12	
	Ventral (subserous fat)	3	
	Hernia in linea semilunaris	1	
	Hernia following operation for appendicitis (gauze drain)	2	
	Hernia following incision in the groin for rupture of the bladder	3	
	Traumatic ventral hernia (strangulated)	1	
X.	Femoral hernia	25	
	Total radical operations	441	

## OPERATION, NOT RADICAL. 18 CASES.

Group XI. Strangulated hernia. Intestine gangrenous or general peritonitis. 10 cases: Inguinal 4 cases; umbilical 1 case; femoral 5 cases.

Group XII. Irreducible inguinal hernia, radical operation impossible because of the extensive matting together of the intestines in sac. Number of cases 4, three of which were strangulated.

Group XIII. Odd cases 4.

(1). Umbilical hernia with extensive tuberculosis of the peritoneum, resection and intestinal suture. Death.

(2). Chronic obstruction of the bowels following the reduction of a strangulated inguinal hernia. Operation. Death.

(3). Reduction "en bloc" of an inguinal hernia. General peritonitis. Operation. Death.

(4). Death on the table before operation was completed. Strangulated inguinal hernia. Gumma of the cerebellum.

The great increase in the number of radical operations for inguinal hernia is worthy of note. The following table shows the relation between the total number of operations and the number of operations for inguinal hernia:

Surgical cases, May, 1889, to August, 1898,	8363
Surgical operations, May, 1889, to August, 1898,	6915
Radical operations for inguinal hernia	375 (5%)

	Total number operations.	Operations for Inguinal Hernia.	
1889-90	532	11	2%
1897-98	693	102	14.7%
Increases	161	91	

The radical operation for inguinal hernia has become with us the most common of all major operations.

#### SEC. I.—DEATHS FOLLOWING OPERATION FOR HERNIA.

##### *Non-strangulated Hernia. 395 Cases.*

Inguinal	362 cases.
Umbilical and ventral	20 "
Femoral	13 "
Died	2 " (about $\frac{1}{2}$ of 1%).

(1). Group I, Case 113. Boy, aged 6 yrs., death on the 7th day. Autopsy, diphtheritic colitis (see history).

(2). Group V, No. 39. Female, at. 36 years. Sudden death 10th day. Autopsy, thrombosis left internal iliac vein, embolism, left pulmonary artery (see history).

##### *Strangulated hernia in which the contents of the sac were in good condition. 48 cases.*

Inguinal	33 cases.
Ventral	3 "
Femoral	12 "
Death	4 " (about 8%).

(1). Group IV, Case No. 12. Inguinal hernia. Male, aged 44 years. Sudden death on the 10th day while patient was writing a letter. Autopsy, arteritis of the coronary arteries of the heart; no wound nor peritoneal infection.

(2). Group X, No. 9. Femoral hernia. Female, aged 46. Death on the 9th day. Autopsy, acute infection of a hydronephrosis of the right kidney; no wound nor peritoneal infection.

(3). Group XIII, Case No. 4. Strangulated hernia. Male, aged 51. Death on the table 10 minutes after beginning of the ether. The patient before operation was in a very critical condition. Autopsy, gumma of the cerebellum; no peritonitis; no gangrene of the intestine.

(4). Group IX, Case No. 20. Umbilical hernia. Male, aged 59 yrs. Death, pneumonia; 3rd day. Ether was used as the anæsthetic.

*Strangulated hernia in which the contents of the sac consisted of gangrenous intestine, or in which general peritonitis was present before operation.* 16 cases: Inguinal 10; umbilical 1; femoral 5. Died, 15 cases. See Groups XI, XII and XIII.

## SEC. II.—ACUTE INFECTIONS FOLLOWING OPERATIONS FOR HERNIA.

Non-strangulated hernia, 395 cases; strangulated hernia in which the contents of the sac were in good condition, 48 cases; total, 443 cases. Ether was the anæsthetic in every case.

	Non-Strangulated.	Strangulated.
(1) Pneumonia	5 cases	1 (death)
(2) Bronchitis	6 "	1
(3) Pleurisy	1 "	0
(4) Phlebitis of the leg	3 "	0
(5) Acute dysentery	2 " (1 died)	0
(6) Double parotid abscess	0 "	1
(7) Acute otitis media	1 "	0
(8) Erysipelas, not connected with the wound (also chicken-pox)	1 "	0
(9) Acute infection of right hydronephrosis	0 "	1 (death)
	<hr/>	<hr/>
	19 cases	4 cases

In only two of these 23 cases did the wounds suppurate—one a case of pneumonia and the other a case of bronchitis. In 3 cases the infection was the cause of death—1 case of acute dysentery, 1 case of acute infection of a hydronephrosis, and 1 case of pneumonia.

In one case of pneumonia the patient died of tuberculosis of the lungs 3 months after operation; in a second case of pneumonia the patient developed an abscess in the apex of the right lung; but from this he was making a rapid recovery 7 weeks after operation. (A letter addressed to this patient, Aug., 1898, was returned marked dead.)

The ultimate result of the remaining 18 cases is excellent. Two cases were children (1 case with acute otitis media and 1 case with chicken-pox); the remainder were adults, one a female.

(10) Wound infection. See Sec. XII (page 292).

Inguinal hernia. 446 cases. 42 cases, 9.5 per cent. In only 11 of these 42 cases of wound infection was the infection acute. There have been no deaths from wound infection. The streptococcus has not been found in any case; only the staphylococcus aureus and albus, and these in each case were combined.

Since the introduction of silver wire and the use of rubber gloves, the number of cases of wound infection has been much decreased.

116 cases closed with silk,	28 suppurations,	24.13%
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Gloves not worn by operator.

104 cases closed with silver wire,	10	"	9.6%
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Gloves not worn by operator.

226 cases closed with silver wire,	4	"	1.8%
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Gloves worn by operator as well as by all the assistants.

Total 446 cases, 42 suppurations, 9.5%.

(These figures are complete to June 1, 1899.)  
There has been but one case of suppuration in 21 cases of umbilical hernia. Among the 26 cases of femoral hernia, infection of the wound has not taken place in any case.

### SEC. III.—COMPLICATIONS FOLLOWING THE OPERATION FOR HERNIA.

The convalescence was uneventful except in the following cases:

(1). In 1 case, an adult, *æt.* 52 yrs., male, with reducible hernia, albumen and casts appeared in the urine after operation, but disappeared after six days. During this time the patient was very

much depressed and suffered from nausea and vomiting. At the present writing, Aug., 1898 (1 yr. 4 mos. after operation), he appears to be in better health than previous to operation.

(2). (Group III, No. 7.) An adult male with non-strangulated hernia developed, 48 hours after operation, symptoms of intestinal obstruction, a very rapid pulse, persistent vomiting and nausea and great distention of abdomen. Relief was given, however, by high enemata. This patient is in excellent health at the present writing (3 yrs. after operation).

(3). One case (Group I, No. 173) in which the wound suppurred and in which an abscess formed in the scrotum, suffered from attacks of pain in the groin and testicle for 6 mos. after operation. There has been no return of the pain up to the present time (a period of about 3 yrs. and 6 mos.).

(4). Atrophy of the testicle has taken place in 8 cases among 109 cases in which the veins were excised. Atrophy has not been observed in a single case in which the veins were not excised (129 cases). See Sec. XX.

(5). Hydrocele has followed in 20 per cent of cases in which the veins were excised and 3 per cent of cases in which the veins were not excised. See Sec. XXII.

(6). Emphysema of the wound, 1 case (Group I, No. 201), which disappeared in 7 days; the wound healed per primam.

#### SEC. IV.—THE ULTIMATE HEALTH OF PATIENTS OPERATED ON FOR HERNIA.

Inguinal hernia, 375; umbilical, 20; femoral, 25; total, 420 cases. Deaths, 2 cases, both inguinal herniæ. Both suffered from ether pneumonia; one died 3 months later from tuberculosis of the lungs. A letter addressed to the other, August, 1898, 3 yrs. after operation, has been returned, marked dead. Of the remaining 418 cases, we have obtained records of 6 deaths at various periods after the operation. All were adults. In one case death took place 5 yrs. after operation; in 1 case, 3 yrs. and 9 mos.; in 2 cases, 2 yrs. and 6 mos., and in 2 cases, 1 yr. and 7 mos. after operation. In none of the cases, as far as we are able to learn, was the cause of death directly or indirectly due to the operation. Of the remaining 412 cases, 57 cases have not been heard from since operation; letters addressed to them have been returned. 355 cases have been examined or heard from by letter during the year 1898

alone. One of the cases of phlebitis (a recent case) is still suffering from the discomfort of a swollen leg; the remaining patients are in good health and suffer no discomfort from the operation.

*Conclusion.* In view of these figures, after an experience of over nine years we are able to say to a patient desiring an operation for a non-strangulated hernia: The probabilities of *death* are less than one-half of one per cent; of *pneumonia*, if a general anæsthetic is given, 1.2 per cent; of phlebitis of the leg, .7 per cent; of suppuration of the wound, 4 per cent, and, since the introduction of gloves, less than 1 per cent; of a recurrence of the hernia, if femoral, none; if umbilical or ventral, in which the recti muscles can be included by the suture, none; if the muscles are too widely separated to be included by the suture, 20 per cent; if an inguinal hernia, less than 4 per cent. Now that we transplant the *rectus muscle* when the conjoined tendon is obliterated, knowing that its obliteration has been the chief cause of recurrence in the lower angle of the wound, and now that we diminish the size of the cord by the excision of the veins or the splitting of the cord, transplanting the veins only, knowing that the larger cord has been the sole cause of recurrence in the upper angle, I believe that the percentage of recurrence will be reduced much below 4 per cent. Thus far in cases in which these modifications have been introduced, there have been no recurrences (see Sec. IX).

Pneumonia following the general anæsthetic is the chief danger in operations for hernia. 5 cases (1.2 per cent) in non-strangulated hernia, two of which died later of tuberculosis of the lungs. One case (2 per cent) in strangulated hernia in which the gut was in good condition, and in this case the cause of death. In 15 cases of strangulated hernia in which the gut was gangrenous or in which peritonitis was present before operation, 14 cases died. 25 per cent of these showed evidences of a broncho-pneumonia at the autopsy; in one case it was the cause of death;<sup>1</sup> in 13 cases peritonitis was also present.

<sup>1</sup> The suture for the gangrenous gut was successful.

## SEC. V.—THE HALSTED OPERATION. CORD TRANSPLANTED.

## (a). THE OPERATION IN BRIEF.

- (1). The high skin incision. Fig. 1.
- (2). The exposure of the aponeurosis of the external oblique muscle, Poupart's ligament and the external ring. Fig. 1.
- (3). (a) The division of the aponeurosis of the external oblique muscle and (b) the division of the internal oblique muscle. Fig. 2.
- (4). The dissection and excision of the sac and the ligation and excision of the veins, and the closure of the opening into the peritoneal cavity. Fig. 3 and Fig. 3a.
- (5). The placing of the deep sutures, transplanting the cord into the divided internal oblique muscle, one suture being placed above the cord and four sutures below. The suture external to or above the cord includes the aponeurosis of the external oblique muscle and the internal oblique muscle above the point of division of the latter muscle. The sutures below or internal to the cord include, on the upper and medial side, the aponeurosis of the external oblique muscle, the divided internal oblique muscle, and conjoined tendon; on the lower and outer side, the divided internal oblique muscle, the aponeurosis of the external oblique and Poupart's ligament. The divided internal oblique muscle is drawn down towards the external ring, and hence is included by the sutures down to or beyond the outer border of the conjoined tendon; the lowest one or two sutures are always made to include the conjoined tendon. The transplanted cord lies between the aponeurosis of the external oblique and subcutaneous tissues, the skin incision is closed with a continuous subcutaneous suture of silver wire, and the wound is dressed with silver foil. Figs. 4, 6 and 7.

## (b). THE OPERATION IN DETAIL.

- (1). The skin incision (Fig. 1). This incision varies in length from 6 to 12 cm. It should, as a rule, extend from a point 3 cm. above the spine of the pubes and 2 cm. above Poupart's ligament to a point 3 cm. below a line drawn from the anterior superior iliac spine to the umbilicus, and if extended should cross this line 3 cm. from the iliac spine. This incision does not run parallel to Poupart's ligament, but at an angle of about 25 degrees to it.
- (2). Poupart's ligament should be clearly exposed by drawing

the lower skin flap outwards and downwards with the retractor and cutting the connective tissue which binds the subcutaneous fat to the ligament. Poupart's ligament<sup>1</sup> should be exposed only to within 2 cm. of the spine of the pubes; further dissection of this ligament is unnecessary, and moreover might endanger its blood supply. Two retractors are now placed in the lower angle of the wound, traction on which more fully exposes the external ring and its contents. This dislocation of the skin wound makes the higher and shorter incision feasible, and for our purpose it exposes the parts as well as if the incision had been carried into the scrotum.<sup>2</sup>

(3). (a) *The aponeurosis of the external oblique muscle* is divided from the external ring upwards and outwards in the direction of its fibres which corresponds to the direction of the skin incision, the division being carried upwards until 3 cm. of the internal oblique muscle is exposed. (Two long silk sutures may be inserted through the edges of the divided aponeurosis, opposite each other, about 3 cm. above the spine of the pubes. These sutures are not only convenient as retractors, but serve as landmarks during the dissection of the sac, and also later during the insertion of the deep sutures (Fig. 2)).

(b) *In most herniae the lower border of the internal oblique muscle* will be found more or less adherent to the fascia covering the contents of the inguinal canal; in such cases it is better to first free these adhesions by dissection. The free lower border of the internal oblique muscle is then caught with two artery clamps, placed 1 cm. apart, and the muscle cut between them for a distance of 3 to 4 cm., not in the line of the skin incision and the divided aponeurosis of the external oblique, but at about right angles to its muscular bundles. *The division of this muscle should be made as far from the linea semilunaris as possible* (see Fig. 8). It is important to avoid teasing or fraying the divided muscle. These two clamps may be left in place, because they serve to control the slight haemor-

<sup>1</sup> In patients who have worn a truss, and especially in those on whom injections have been used, there is often much new connective tissue, binding the subcutaneous fat to Poupart's ligament and the aponeurosis of the external oblique muscle.

<sup>2</sup> In strangulated herniae, large irreducible omental herniae and in very fat people it is sometimes necessary to enlarge the skin incision upwards, but never downwards over the pubes, cases in which the rectus muscle is transplanted excepted. See Sec. IX.

rhage and enable one to draw the divided muscle downwards during the insertion of the deep sutures. (The clamps can be replaced later by long silk sutures.)

(4). In proceeding with the *division of the coverings of the sac* from above downwards, the retractors placed in the lower angle of the wound are drawn apart and downwards. This dislocation of the skin wound, with the division and retraction of the aponeurosis of the external oblique and the internal oblique muscle, exposes to view most fully and satisfactorily the contents of the inguinal canal.

The coverings of the sac are picked up with forceps (mouse-toothed) and divided; if very thin they may be gently torn. The infundibuliform fascia can, as a rule, be easily recognized; and as soon as it is divided the sac (indirect hernia) is exposed. The division of these fasciæ is begun near the neck of the sac and continued downwards toward the pubes for a distance sufficient to uncover a small sac or the neck of a large one. As the sac is lifted with forceps out of the inguinal canal the larger bundle of veins and the vas deferens are also drawn upon and appear as shown in Figs. 3 and 3a.

The sac is now carefully separated from the veins and vas deferens. This dissection can usually be done with a knife or scissors with less damage to the blood-vessels and vas deferens than by tearing. The separation is carried up to and beyond the neck of the sac. When isolated the sac is held upwards and outwards out of the wound by an assistant, while *in certain cases* the larger bundle of veins is separated from the vas deferens, ligated and excised. This larger bundle of veins—usually 5 to 7 in number—lies between the sac and the vas deferens, and is distinctly separated from the vas deferens by loose connective tissue (see Figs. 3 and 3a). These veins, if they are to be excised, should be caught with two artery clamps, the first placed a few centimetres above the pubes and the second near the neck of the sac. An assistant raises these clamps (see Fig. 3a), while the operator passes two ligatures about the veins, the first about 1 cm. above the upper clamp placed near the neck of the sac, and the second 1 or 2 cm. on the testicular side of the lower clamp. These ligatures are threaded in a large curved needle, the blunt end of which is thrust between the veins and vas deferens. The blunt end of the needle is used in order to avoid pricking the walls of the veins. Both ligatures are for the moment

left uncut; the mass of veins between the two ligatures is then excised with scissors, a stump being left beyond each ligature of at least 1 cm. In cutting the tissues which loosely bind the veins to the vas deferens, one or two small vessels may require a fine ligature. The ligated stumps of the veins are allowed to retract out of view, the upper one behind the internal oblique muscle and the lower one beneath the skin over the pubes; and the vas deferens with its arteries and the smaller veins drops back into the inguinal canal.

The sac is opened, its contents reduced, and the opening into the peritoneal cavity closed with a continuous suture of black silk; the excess of sac is excised. Now and then one or two vessels in the neck of the sac require a ligature. The stump of the sac retracts out of view behind the internal oblique muscle.

During the dissection, closure and excision of the hernial sac, and the ligation and excision of the large bundles of veins, the vas deferens and its immediate vessels should be handled very little, and should not be torn from their bed in the inguinal canal. It is of the greatest importance to keep this in mind during the entire operation, whether veins are excised or not.

(5). Before the insertion of the deep sutures of silver wire, all bleeding points which have been clamped should be tied, and the ligatures which were left long on the stumps of the excised veins should be cut short, the stump being first drawn out into view for inspection.

The retractors which have been in the lower angle of the wound are now shifted to the upper angle and remain there during the insertion of the upper three sutures which are passed first.

The vas deferens is now for the first time disturbed. It lies on the floor of the inguinal canal, accompanied by a few small veins and its artery and the spermatic artery; these structures are held together by loose connective tissue, and to the posterior wall of the inguinal canal by a delicate membranous structure suggestive of the mesentery of the intestine in which minute vessels can be seen (see Figs. 3 and 3a). It is important for the ultimate welfare of the testicle to handle these structures as gently as possible, especially when the veins are excised. The vas deferens is picked up with great care, and a blunt-pointed hook passed beneath it tears its mesocord in the centre; ultimately the entire mesocord is torn, but

the vessels of the vas deferens are not divided or injured. The vas deferens is lifted into the upper angle of the divided internal oblique muscle, and held in this position until all the deep sutures have been inserted.

The wound is now ready for the insertion of the deep sutures. In the ordinary operation the number of these is five, one above (passed first) and four below the cord. The first suture includes the aponeurosis of the external oblique muscle and the internal oblique muscle just above the point of the division of the latter (see Fig. 4). Before and during the insertion of this suture traction should be made on the clamps (or ligatures) placed on the ends of the divided internal oblique muscle, in order to pull it down into the wound as far as possible.

In passing the next three sutures traction should still be made on the divided portion of the internal oblique muscle. In the division of this muscle two flaps have resulted; the lower outer one, on the side of Poupart's ligament, is the smaller. As a rule, three of the four sutures below the cord can be made to include the upper medial portion of this divided muscle; and one and one-half, or sometimes two, below the cord are made to include the lower outer portion (see Fig. 4).

Suture No. 2 includes the following structures: (1) Aponeurosis of external oblique; (2) divided internal oblique (upper medial portion); (3) same muscle, lower outer portion; (4) Poupart's ligament. This suture in returning includes the same structures in reverse order.

Suture No. 3 includes the same structures, except that in returning, as a rule, it cannot be made to include the lower outer portion of the divided muscle. If such be the case, the needle, in passing through Poupart's ligament or the aponeurosis of the external oblique the second time, is sometimes made to pierce this aponeurosis twice, so that the aponeurosis may be folded upon itself when the suture is drawn home.

Suture No. 4 includes the aponeurosis of the external oblique and the internal oblique on the upper side, but only Poupart's ligament (aponeurosis of external oblique), and perhaps the cremaster muscle, on the lower side. With this suture also, and with suture No. 5, the needle in returning is made to catch Poupart's ligament (aponeurosis of external oblique) a second time.

Suture No. 5 includes above, the aponeurosis of the external oblique and the conjoined tendon, and perhaps occasionally the sheath of the rectus; on the lower side, Poupart's ligament, and sometimes the cremaster muscle.

The cord lies snugly but comfortably between sutures Nos. 1 and 2, and is imbedded in thick muscle. The needle in taking sutures Nos. 2 and 3 should pierce the mesocord, great care being exercised not to injure the vas deferens or any of its vessels. The two arms of each suture and the sutures themselves should be about 1 cm. apart. It is better and also more convenient to begin the mattress sutures in each instance from above, so that the loops of the sutures draw on Poupart's ligament and the twisted ends lie on the aponeurosis of the external oblique (see Figs. 4 and 6). This method of introducing the stitches seems to present two advantages: (1) the loops (straight pull) are less likely to tear Poupart's ligament; and (2) in passing the second half of the mattress suture Poupart's ligament can, more easily in this than in the reverse direction, be caught two or three times with the needle and folded upon itself, a procedure which seems, in great measure, to avoid the danger of tearing this aponeurosis. Each suture should enter the aponeurosis of the external oblique about 1 cm. from its cut edge, pass directly into the internal oblique muscle and out through its cut surface, enter the cut surface of the muscle on the lower side and emerge from the aponeurosis about 1 cm. from its cut edge. Broad, thick surfaces, by this procedure, may be snugly approximated without risk of strangulation. When the sutures have been twisted, the tip of the little finger should not be able to enter the wound between any two of them.

In passing the deep sutures it is better not to attempt to make the needle pierce the tissue on both sides of the wound at one time, but rather to draw the needle out, pass it beneath the cord and then reintroduce it into the tissues on the other side. In this way the needle can be passed truer and the resulting approximation will be more accurate. Inasmuch as each suture is a factor in the result of the operation, too much care cannot be given to every single step of this part of the operation.

The sutures are drawn upon and the tissues approximated; and before the wires are twisted it is a good plan to insert the little finger between the sutures to ascertain the snugness of the approxi-

mation; if an additional suture seems required, it can be easily inserted. The sutures are twisted about six times, and the cut twisted ends should be a little less than 5 mm. long; these are caught with blunt forceps and turned so that the sharp ends do not project towards the skin. In some cases the aponeurosis just above and just below the transplanted cord is approximated with a single suture of very fine silver wire, silk or catgut. The wound at this stage is shown in Fig. 6.

(9). The skin wound is closed with a continuous buried skin suture of silver wire (Fig. 7). It is covered with about three layers of silver foil and over this one or two layers of the paper in which the foil is packed and sterilized; over all this comes a large dressing of dry gauze. The dressing is very often held in place with plaster of Paris bandages and narrow bass-wood splints, the splints extending from just above the knee to near the costal margins.

The writer has in this section confined himself strictly to the description of the typical Halsted operation, including the ligation and division of the veins.

#### SEC. VI.—THE DISCUSSION OF THE STEPS IN THE HALSTED OPERATION.

(1). *The higher skin incision.*—(a) It avoids cutting numerous vessels, chiefly branches of the superficial external pudic, and saves from 6 to 8 ligatures. (b) It saves cutting the skin, over and above the pubes, which it is impossible to sterilize on account of the number and depth of the hair follicles. (c) The high incision is more easily kept covered with the dressing, especially if catheterization is required. (d) It gives ample room for the division of the aponeurosis of the external oblique and internal oblique muscles, and, if necessary, for opening into the general peritoneal cavity above the neck of the sac. In making this incision only a few vessels are divided. From two to four of the superficial epigastrics should, as a rule, be ligated. In cases in which the operator decides to transplant the rectus, the skin incision should be enlarged downwards 1 to 2 cm. The healing of the wound has been distinctly better since the introduction of the higher skin incision.

(2). *The division of the aponeurosis of the external oblique muscle.*—The high skin incision being made, the lower flap should be dissected outwards and downwards until Poupart's ligament is fully exposed, because during the insertion of the deep sutures the

full and clear exposure of this ligament is of great importance; it allows a more accurate insertion of the deep sutures. Before dividing the aponeurosis, retractors should be placed in the lower angle of the skin incision, dislocating it downwards and exposing the external ring. The division of the aponeurosis should begin in the centre of the arc of the ring. It is very important to find the external ring in every case before dividing the aponeurosis, otherwise one may divide it too high and expose the rectus or internal oblique muscle instead of the inguinal canal. Long silk ligatures inserted in the aponeurosis will be found very useful as retractors and landmarks.

(3). *The division of the internal oblique muscle.*—This muscle was originally divided solely for the purpose of conducting the cord through the thickest tissue possible. It was then discovered that the triangular flaps made by the division of the muscle could be pulled down into the wound and included in many of the deep sutures as far as, and in some cases beyond, the outer border of the conjoined tendon. The muscle could be transplanted, if one may use this expression, and the wound strengthened by the introduction of muscle between the other available tissue, which in inguinal hernia is chiefly aponeurotic. We were led to make this use of the divided internal oblique muscle from our observation on the value of muscle in other laparotomy wounds. In the earlier operation the division of the muscle was postponed until the sac had been partly isolated and the veins ligated and excised; but it was soon discovered that to divide the muscle immediately after the division of the aponeurosis of the external oblique facilitated the operation very much in every case, especially in strangulated or large omental herniæ.

The value of the preliminary division of the internal oblique muscle in strangulated and other difficult herniæ has proved to be so great that the writer feels justified in describing his method in detail.

(a). In *strangulated* hernia the skin incision should extend a little higher than usual; the aponeurosis of the external oblique muscle and the internal oblique muscle are then divided as already described. After incising the muscle, the transversalis fascia<sup>1</sup> and

<sup>1</sup> Neither the transversalis muscle nor the muscular part of the external oblique is exposed in the ordinary operation for inguinal hernia.

peritoneum are divided at once, the peritoneal cavity being opened into above the internal ring and the seat of constriction. A blunt pair of scissors, curved on the flat, can now be introduced between the sac and its contents, and with them as a guide the constriction is cut and the sac widely opened. [This procedure can easily be done under cocaine.] The abundant room given by the division of the muscle and peritoneum enables the operator to meet with safety, ease and rapidity any problem that the contents of the sac may give rise to. If the condition of the strangulated gut is questionable, it may, having been reduced, be sought again more easily. If the intestine is gangrenous the operator has ample room in which to pack off the general peritoneal cavity and proceed to resect and suture, or to draw out the loop and suture it in place. After the contents of the sac have been properly disposed of, and if they do not require further observation, the opening into the general peritoneal cavity is closed and the remainder of the operation proceeded with in the usual way. If, on the other hand, the returned gut needs reinspection, the opening into the peritoneal cavity, instead of being closed, is plugged temporarily with a piece of gauze; the operator then proceeds to dissect the sac, ligate arteries and do everything which can be done before closing the wound in the peritoneum. At the end of a few moments the intestine may have recovered its circulation sufficiently to indicate whether or not it shall be returned to the abdomen. In some cases of very large strangulated hernia the internal oblique muscle is divided higher than usual; and in this case two mattress sutures are placed above the cord, the latter passing out between the second and third sutures, and not at the upper angle of the divided muscle; otherwise there might be too much traction on the cord and testicle.

(b). *Omental hernia.* After the division of the internal oblique muscle the writer opens at once into the peritoneal cavity above the neck of the sac; from this position and through the larger opening he has demonstrated that one can more easily and with less danger inspect the contents of the sac, reduce the contents or ligate the omentum. Especially is this so in cases in which the omentum is adherent and the operator decides to remove it. Through the larger opening the omentum is ligated above the neck of the sac, the peritoneum divided across above the neck of the sac, the opening into the peritoneal cavity closed, then the sac and omentum together are

removed from above downwards. If the omentum is not adherent the opening into the sac is enlarged from above downwards, and through this larger opening the mass is easily replaced, or if after withdrawing the omentum one should decide to remove it, the ligated stump can be replaced through the larger opening without any difficulty. It can be more easily inspected after its reduction, and in case of haemorrhage (which now and then takes place even after most careful ligations) the stump can easily be found and drawn out of the wound and the bleeding vessels ligated.

(c). The writer has been so impressed with the value of the preliminary division of the internal oblique muscle and the incision of the peritoneum above the neck of the sac in strangulated and omental hernia that during the last two years he has followed this method in every case of hernia.

By following this plan the operator is at once able to inspect the contents of the sac and more easily meet any difficulty. The peritoneal cavity can be inspected and the finger introduced and the condition of the conjoined tendon ascertained. The peritoneum can be divided above the neck of the sac (where it is always less adherent) and with less danger of injury to the vas deferens and vessels; and after closing the opening into the peritoneal cavity the sac can be *removed from above downwards*, a procedure which can be done more rapidly and with less danger to the cord than the dissection from below upwards (the usual method). It allows a more satisfactory study of the anatomy of the sac and the inguinal canal.

One of the most important points to have in mind during the division of the internal oblique muscle is the position of the linea semilunaris. The muscle should be divided at some distance from this line (the correct position and direction are shown in Fig. 8). The object of this division is to make two triangular muscle flaps. Dividing the muscle near and in the direction of the linea semilunaris diminishes the size and strength of the upper and medial muscle flap and consequently the strength of the wound about the transplanted cord. During the last year the writer has used a preliminary suture of catgut to hold the divided and transplanted internal oblique muscle snugly in place (Fig. 5).

In some criticisms of the Halsted operation it has been suggested that the more extensive wound of the abdominal wall made

by the division of the internal oblique muscle would of itself predispose to a recurrence in the upper angle. Our results, after nine years' experience, positively disprove this supposition. In 56 operations in Groups II to V inclusive (in which the cord has been excised or not transplanted), there is but one recurrence in the upper angle of the wound. (Group V, No. 14.) In this case the internal oblique muscle was placed so high and was so thin that it was not divided nor included by the sutures. The recurrent hernia took place through a split in the aponeurosis of the external oblique muscle. In 109 cases in Group I, Halsted's operation, in which the vas deferens with its immediate vessels was transplanted after the ligation and excision of the veins, there is not a recurrence nor even a weakness in the upper angle of the wound. The ultimate result in every one of these 165 cases from six months to nine years after operation is known, and with very few exceptions the internal oblique muscle was divided. In 86 cases, in Group I, Halsted's operation, in which the cord was transplanted *in toto* without the excision of the veins, there have been 8 slight recurrences at the position of the cord, 5 in 75 cases in which the wound healed per primam, and 3 in 11 cases in which the wound suppurated. The recurrence in these cases was due most likely to the larger cord, the diameter of which was greatly increased by the bundle of veins.

The divided and transplanted internal oblique muscle can be utilized to line only the outer two-thirds of the wound, so that in cases in which the lower and inner third has lost its natural support, the conjoined tendon, the rectus muscle should be exposed and transplanted (see Sec. IX).

We have lately demonstrated that the transplantation of the rectus muscle can be more easily done after the division of the internal oblique muscle.

(4). *The dissection of the sac.*—The writer has used during the last two years the following method: After the division of the aponeurosis of the external oblique muscle and the internal oblique muscle, the peritoneum is incised above the neck of the sac and the peritoneal cavity opened into; the contents (if any) of the sac

are then reduced. The peritoneum is divided across above the neck of the sac and separated from the vas deferens and vessels for a short distance; the opening into the peritoneal cavity is closed with a continuous suture of silk, the sac is then removed from above downwards. The dissection is very conveniently accomplished by inserting one or more fingers into the sac; with these the operator can draw the sac in any direction, and by spreading the fingers the sac and adherent tissue are put on a stretch. The separation is made with a knife, cutting close to the sac. The procedure allows the operator to see clearly every strand of tissue to be divided, and during the entire dissection the vas deferens and vessels are plainly in view. As the separation proceeds downwards the sac is divided in the direction of its long axis to allow the fingers to be introduced more deeply until the sac is completely excised. It is seldom necessary to draw the testicle out of the scrotum (Photo No. 15).

In congenital hernia the sac is removed close to the testicle; no suture is made of the remaining tunica vaginalis because hydrocele has followed in the *majority of cases* sutured, but as yet it has not been observed in *cases not sutured* (see Sec. XXII).

In congenital hernia the sac holds a more intimate relation to the cord than in the acquired form (see Sec. XV), and it is often very difficult to separate the sac without injury to the vessels of the cord. In some cases it is better to leave a portion of the sac with the cord. In acquired hernia also the sac may be so adherent to the cord that any attempt at a complete separation can only be done with risk of injury to the vessels of the cord. In these cases, also, it is safer to leave a portion of the sac with the cord.

(5). *The ligation and excision of the veins.*—When it has been decided to excise the veins, these vessels are separated from the vas deferens first near the neck of the sac, divided between two ligatures or one ligature and a clamp, and then with the sac are separated from the vas deferens and other tissues from above downwards; the veins are again ligated at some distance from the testicle and removed with the sac. If it is decided to ligate and excise the cord, the procedure is similar, except one should use a separate ligature for the vas deferens and its immediate vessels. If it seems best to remove the testicle, the cord is ligated as before near the neck of the sac, and the cord, sac and testicle can be rapidly removed in one mass from above downwards.

The study of the ultimate results has demonstrated the great importance of the reduction of the size of the cord by the ligation and excision of the larger bundle of veins. 109 cases in which the veins were excised are all perfect results. 86 cases in which the veins were not excised give 8 recurrences at the position of the cord.

In Sec. XX the immediate and ultimate condition of the testicle after excision of the veins is reported. In the earlier cases in which the veins were excised, we did not appreciate the importance of handling the vas deferens and its immediate vessels with such great care nor of preserving as much as possible the mesocord from injury. Our object was to diminish the size of the cord so that without doubt in many of these cases all the vessels accompanying the vas deferens were either ligated or injured. After 58 of these early operations, atrophy of the testicle took place in 8 cases. In these 58 cases the vas deferens was transplanted. In 3 cases the cord was subjected to the same treatment, except that the vas deferens was not transplanted; atrophy followed in two cases. In 51 cases the veins were excised after the new method described in this paper and the vas deferens and its immediate vessels transplanted. Atrophy of the testicle has not followed in any instance. In two cases the veins were ligated and excised, but the remainder of the cord was not disturbed from its bed in the inguinal canal. In both of these cases the testicle is normal.

Similar observations have been made after operation for varicocele. If the veins are simply ligated and excised, and the vas deferens and its immediate vessels and their mesocord not torn nor disturbed, the swelling of the testicle after operation is very slight, if any, and atrophy has not been observed. If, however, the surgeon tears the cord from its bed in the inguinal canal during the operation (which is unnecessary), a very marked epididymitis is very likely to take place, and probabilities of an atrophy of the testicle are increased.

If it is decided to excise the veins in the operation for hernia, it should be done as described in this paper, without disturbing the remainder of the cord and its mesocord. The cord then becomes such a small affair that it is a question in my mind whether it is necessary to transplant it. In the last two cases of hernia I have

simply excised the veins, leaving the remainder of the cord undisturbed, as in an operation for varicocele. The wound was then closed as described in a typical Halsted operation. Our observation clearly demonstrates that the excision of the veins promises perfect results. It is yet a question whether it is necessary to transplant the very small remaining portion of the cord. Unquestionably, this portion is subjected to more traumatism by transplantation, although as yet we have not observed atrophy when it is done as described by the writer.

#### THE ULTIMATE RESULTS FOLLOWING OPERATION FOR INGUINAL HERNIA.

In this connection we shall discuss the cases of the several groups (I to VIII) in two groups: (A) those in which the wound healed *per primam* and (B) those in which suppuration occurred in a part or in the whole of the wound, and each group in two classes: (a) those in which the conjoined tendon is wide and firm and (b) those in which the palpable portion of the conjoined tendon is obliterated as described in Sec. IX.

For four years we have been writing every six months to our patients operated on for hernia. The last reports or examinations, with few exceptions, were made between August and December, 1898. Every recurrence observed up to the present date, April 1, 1899, is recorded. Of 394 patients operated on for inguinal hernia, 238 have been examined (most of these by the writer), 33 reported by their physicians and 36 heard from by letter; 41 cases are recent operations not heard from since their discharge<sup>1</sup> and 44 patients have been lost sight of, although every effort has been made to trace them.

In every case examined a careful note was made at once of the condition of the wound, the testicles and the health of the patient since operation, and this note was filed with the history of the patient.

#### SEC. VII.—ULTIMATE RESULTS HALSTED'S OPERATION. GROUP I.—CORD TRANSPLANTED (268 CASES).

##### *Group A.—Wounds which Healed Per Primam, 242 Cases.*

Perfect results, 208 cases.

Slight weakness in the scar, 4 cases.

<sup>1</sup> With few exceptions, examined or heard from March and June, 1899.

Recurrences, 6 cases (less than 3 per cent).

Lost track of since operation, 25 cases.

Death after operation, 1 case.

The results are recorded as perfect when the wound is solid, and when at the position of the cord and at the external ring no opening or impulse can be made out. Such perfect results are to be recorded in 208 cases. These cases are divided according to the lapse of time since the operation as follows:

8 to 9 yrs.	1	3 to 4 yrs.	22
7 to 8 yrs.	1	2 to 3 yrs.	20
6 to 7 yrs.	7	1 to 2 yrs.	41
5 to 6 yrs.	10	6 mos. to 1 yr.	41
4 to 5 yrs.	22	Less than 6 mos.	41

It should be noted that 5 of the 6 cases recorded as recurrences are very small affairs, and in each case the hernia is situated at the position of the cord, the opening in the largest admitting only the index finger. Cases Nos. 6, 174, 176, 196 and 227. In these five cases the veins *were not excised*. Two have been operated on a second time (Nos. 176 and 196). In Case No. 6 it is 8 yrs. and 6 mos. since the operation. The patient considers himself cured. In one case (No. 168) the recurrent hernia is situated in the lower angle of the wound and is associated with the *obliteration of the conjoined tendon, and represents the only complete recurrence after a Halsted operation*.

In the four cases recorded as "weakness in the scar" (Nos. 7, 33, 43 and 51) there is a slight bulging, but no opening to be noticed. The weak place in these cases has not increased in size over periods of 4 to 8 yrs.

*Recurrences. Halsted's Operation. Wounds which Healed Per Primam.*

(1). Case No. 168. Age 45 years, complete recurrence. Small, left inguinal hernia, reducible, incomplete, acquired, indirect, of 20 years' duration. Operation 23-1-'97 (Halsted); conjoined tendon obliterated, closed with silver wire. Examined after 1½ months; wound solid. After 7 months the patient writes that there is a swelling in the lower angle of the wound which is as large as the original hernia. He wears a truss.

(2). Case No. 176. Age 30 years. Medium, right inguinal hernia, reducible, acquired, indirect, complete, of 18 years' duration. Operation 21-4-'97 (Bloodgood), closed with silver wire, conjoined tendon wide and firm. Small bulging noticed in the upper angle of the wound four months after operation. Second operation 22-11-'97 (Bloodgood) (see Group I, Case 206, for full description of the small recurrence along the transplanted cord). In this case the rapid recurrence can be perhaps attributed with more justice to the operator than to the method, in that, inadvertently, the sutures above and below the cord were not placed sufficiently snugly. It is also noted in this case that the internal oblique muscle was thin.<sup>1</sup>

(3). Case No. 196.  $\text{\textcircled{A}}$ Et. 52 years. Very large, left inguinal hernia, reducible, complete, acquired, indirect, of 16 years' duration, truss of no value. The hernia extends down to the level of the middle of the thigh, the opening into the peritoneal cavity is very large. The conjoined tendon is obliterated. Operation August 26, 1897 (Bloodgood). Veins not excised. Typical Halsted operation, with the transplantation of the rectus muscle. Wound closed with silver wire. Healing per primam. August, 1898, 1 year after, the patient returns with a slight recurrence at the position of the transplanted cord; exactly similar to Case No.

<sup>1</sup>The patient informed me just before leaving the hospital after the second operation that he began riding a bicycle one week after his return home, that is, about five weeks after the first operation. At the end of a ride of some 25 miles he fell from his wheel and thinks that he strained himself, because afterwards he suffered a good deal of pain in the wound. He, however, continued riding his bicycle at intervals and did not spare himself in his work or in his exercise. About 2 months after the operation he remembers climbing a fruit-tree and straining himself and again experiencing pain in the wound. This patient had been advised not to attempt any violent exercise or heavy work for some 2 or 3 months after operation (the usual advice given to all patients after operation for hernia or laparotomy). Ordinarily we have not advised against any form of exercise or work after two or three months. The majority of our patients operated on for hernia are laboring men, and do the heaviest kind of lifting and work. One patient, a policeman, is a well-known amateur wrestler who has experienced no discomfort from his wound; he was last examined in August, 1898, 2 years and 4 months after operation. Another patient, a boy 12 years old, was kicked on the abdomen in the region of the hernial scar 1 year after operation. He was admitted to the hospital a few hours after injury and the abdomen showed every evidence of contusion. There has been, however, no recurrence of the hernia; last examination August, 1897, 3 years after operation.

176 just described. This appeared 7 months after operation. Second operation August 22, 1898. The recurrence is situated just above the position of the transplanted cord, the opening admits the index finger, the bulging of the peritoneum is very slight, the veins accompanying the cord are unusually large. The divided internal oblique muscle, which had been approximated about the cord, is represented by strong, thick scar tissue. The lower portion of the wound is solid and the transplanted rectus muscle is in place. The recurrence seemed to be due to the large size of the cord made by the larger bundle of veins. June, 1899, perfect result since second operation. (The cord was excised.)

(4). Case No. 6. Age 37 years. Large, right inguinal hernia, reducible, complete, acquired, indirect, of 2 years' duration. Operation 21-2-'90 (Halsted). Veins not excised. Closed with silk. In February, 1891, one year after operation, he was exhibited at the Medical Society by Dr. Halsted as a perfect result. After 3 years and 4 months an examination still showed a perfect result. After 4 years the weak place was found. The patient had not noticed it and considered himself cured. At an examination after 6 years and 8 months the weak place was not found, but in 7 years and 7 months it was again made out (see photograph No. 11). The patient is not aware of it. The small opening is no larger than when noted in 1894. The last three examinations were made by the writer. The patient does very heavy lifting. *Practically this is a perfect result.*

August 29, 1898, 8 years and 5 months since operation. The writer has just examined this patient. When he stands and coughs one sees a small bulging 1 x 1 cm.; the opening at the position of the cord just admits the tip of the index finger. The patient considers himself cured. He is in perfect health. The testicle is normal. June, 1899, examined; no change.

(5). Case No. 174. Age 41. Partial recurrence, small, left inguinal hernia, reducible, incomplete, acquired, indirect, of 4 years' duration. Operation 10-3-'97 (Garrett). Veins not excised. Closed with silver wire. Examined 5 months later; wound solid. Examined after 9 months; weak place found. The patient is not aware of its existence. August, 1898, examined, 1 year and 5 months; no change. June, 1899, examined; no change.

The bulging and opening in this case are a little larger than in No. 6, and smaller than in Nos. 176 and 196.

(6). Case No. 227-228.  $\text{\textcircumflex}$ Et. 38 years. Recurrence on the right side three months after operation at the position of the transplanted cord. *The veins were not excised.* Large, right and left inguinal hernia, reducible, complete, but conjoined tendons wide open. Operation 25-3-'98 (Finney, right side, Mitchell, left side). Wounds closed with silver wire. Healing per primam, December, 1898. Examination 6 months after operation. A bulging on the right side similar to case No. 174 has been noticed three months; the result on the left side is a perfect one. June, 1899, examined; no change.

*Slight Weakness in the Scar. Wounds which Healed Per Primam.*  
*Halsted's Operation, 4 Cases.*

(1). Case No. 33. Age 28 years. Small, right inguinal hernia, reducible, acquired, indirect, incomplete, of 7 months' duration. Operation 3-12-'91 (Halsted). Closed with silk. The patient is of very poor muscular development and has a very thin abdominal wall. Examination 3 months after operation disclosed a slight bulging and impulse between the middle third of the scar and Poupart's ligament. Two years after operation the patient was operated on for a left inguinal hernia, and the wound on the right side was explored. There was no evidence of a recurrence. (For results of examination after 6 years and 8 months, see note under history. Photograph No. 13.) *This is practically a perfect result.*<sup>1</sup>

(2). Case No. 43. Age 21 years. Small, left inguinal hernia, reducible, acquired, indirect, incomplete, of two weeks' duration. Operation 16-6-'92 (Finney). Closed with silk. Examination (last April, 1894) after 1 year and 10 months showed between the middle third of the scar and Poupart's ligament an area of bulging 2.5 cm. in diameter and an impulse on coughing can be made out. The patient noticed this 10 months after operation, and it has not increased in size.

(3). Case No. 51. Age 34 years, colored. Large, right inguinal hernia, reducible, complete, acquired, of 2 years' duration.

<sup>1</sup> This case has been examined again March and June, 1899, and the swelling is a hydrocele of the cord. The wound is solid.

Operation 23-3-'93 (Halsted). Wound closed with silk. November, 1894. Readmitted for observation. Dr. Halsted's remarks<sup>1</sup> on this case in his discussion on hernia in Philadelphia are as follows: "The case which furnishes the nearest approach to a recurrence was operated upon about two years ago, and is now under daily observation. The man has the physiognomy of a Hindoo, but is classed as a negro. He is about thirty-five years old, not more than half-witted, and was on admission, and still is, much emaciated and exceedingly feeble. Within the first twenty-four hours he got out of bed; possibly he repeated this act of disobedience daily. The wound healed absolutely per primam. There is at present, but only on coughing, a bulging of the very thin, flabby abdominal wall from the inner almost to the outer end of the scar. The local condition is not bad enough to demand a second operation."

(4). Case No. 7. *Æt.* 39. Small, left inguinal hernia, reducible, incomplete, acquired, direct, of 6 weeks' duration, following heavy lifting. Operation 20-5-'90 (Halsted). Veins not excised. *Conjoined tendon obliterated.* Wound closed with silk. Opened within 24 hours for haemorrhage. Closed again on the third day; healing p. p. August, 1898. (8 years.) Admitted again to this hospital with malaria. Upper two-thirds of the wound solid. In the lower third there is a slight bulging and impulse; the tissues are distinctly thinner. The patient does heavy lifting and considers himself cured. Practically it is a perfect result.

*Group B. Halsted's Operation. Wounds which Suppurred,  
26 Cases.*

(a). Partial recurrence in 5 cases: Nos. 2, 21 and 224, situated at the position of the transplanted cord; Nos. 22 and 94, situated at the lower angle of the wound.

(b). Slight weakness in scar in 3 cases, Nos. 8, 11 and 32.  
(c). Lost track of since operation, 6 cases.  
(d). Perfect results, 12 cases: 9 years, 1 case; 6 years, 2 cases; 3 years, 4 cases; 2 years, 2 cases; 1 year, 3 cases.

It is to be noted that in Cases Nos. 2, 21 and 224 *the veins were not excised*; the recurrent herniæ are all about the same size,

<sup>1</sup> American Journal of the Medical Sciences, July, 1895.

similar to Cases Nos. 176 and 196. It is 8 years since the recurrence appeared in Case No. 2, and it has not increased in size nor does it give any discomfort. In Case No. 21 a second operation was done; the wound suppurred and a second and similar recurrence took place, which has not increased in size over a period of 4 years. Case No. 224 is recent. In Case No. 22 the recurrence took place 5 years after operation, and a second operation was performed because of strangulation. At the present writing, September 1, 1898, 1 year and 4 months since the second operation, the result is a perfect one. In Case No. 94 the small recurrence has just been noted, 4 years since operation. The patient is not aware of its presence.

*Recurrences. Halsted's Operations. Wounds Suppurating.*

(1). Case No. 2. Aged 20 years. Large, right inguinal hernia, reducible, complete, acquired, of 2 months' duration. Operation 17-6-'89 (Halsted). Wound closed with silk, healing per primam. This patient got out of bed on the second day to urinate and most likely at intervals afterwards; he was discharged from the hospital on the 10th day for insubordination. He returned 2 months after operation with a sinus in the upper angle of the wound due to an abscess which had opened about 3 weeks before. This sinus closed about 6 weeks after the discharge of 2 silk sutures. Examination June, 1892, 3 years after operation; 2 cm. below the upper angle of the wound, corresponding to the stitch abscess and sinus, there is a small bulging and impulse when the patient stands or coughs, and the index finger finds an opening about 1 cm. in diameter. Patient states that he noticed this bulging 6 months after operation, and that it has not increased since. It gives no discomfort and he considers himself cured. He is a blacksmith. December, 1897, 8 years and 6 months after operation. Patient is in perfect health and is a strong, muscular man; the bulging and opening noted 4 years ago have not increased in size. It gives him no discomfort and he does not wear a truss; he considers himself cured. September, 1898. Letter. No change. April, 1899, examined; no change.

(2). Case No. 21. Age 22 years. (3-6-'91.) The operation (operator Halsted) was a very difficult one, due to adhesions; wound closed with silk. It was completely opened on the 7th day; the

upper angle was distended with blood; the wound healed in 6 weeks. Eight months after operation an opening 2.3 cm. in diameter was made out in the upper angle of the wound, through which a small reducible hernia protruded. Second operation (Finney 9-6-'92) 10 months after first operation. The sac was excised and closed, and the scar tissue about the opening was approximated with silk. During the operation the cord was not exposed; it was situated below the opening. The wound suppurated and was again opened. Recurrence took place in about 8 months, but has not increased in size during a period of 5 years. Last examination October, 1897 (see photograph No. 14). At the second operation in this case the scar tissue should have been excised and muscle sought for and sutured. The recurrence gives so little discomfort that the patient will not consent to a third operation. He wears a truss.

(3). Case No. 22. Aged 45. (26-6-'91.) (Operator Halsted.) The wound in this case was completely opened on the 4th day because of its distention with blood. Healing in 10 weeks. A sinus persisted in the lower angle of the wound for 8 months. The wound remained solid for 5 years. At this time the patient was ill with bronchitis; after two months of coughing he noticed a bulging in the lower angle of the wound. One month after its appearance the hernia became strangulated and he was admitted to the hospital for operation April, 1897 (see Group IV, Case No. 19, operator Bloodgood). The testicle was removed; the wound closed with silver wire. All the scar tissue was excised; the conjoined tendon which had given way was excised with the scar tissue; the internal oblique was divided and the *rectus muscle transplanted*; healing per primam. Last examination September, 1898, 1 year and 5 months; wound solid. Perfect result.

(4). Case No. 224.  $\mathcal{A}$ Et. 60 years. Large, left inguinal hernia, reducible, complete, acquired, indirect, of 51 years' duration, truss worn 38 years. Operation 14-3-'98 (Cushing). Wound closed with silver wire; also operation for haemorrhoids. On the 16th day the entire skin incision was found to be open, due to a superficial necrosis along the edges. Complete healing 9 days later. No sinus; no discharge of a deep silver wire suture. Examined 3 months afterwards; a small bulging and opening situated at the position of the transplanted cord. Similar to Cases Nos. 2 and 21. Examination November, 1898, 8 months; no change.

(5). Case No. 94.  $\text{\textit{Ae}}$  34 years. Double, small inguinal herniæ, reducible, complete. Operation 27-6-'94 (Finney). Both sides. Wound closed with silk. Both skin incisions opened within 24 hours for acute infection; complete healing in 6 weeks. No sinus nor abscess. Examination August, 1897, 3 years 2 months. Both wounds solid. Examination August, 1898, 4 years 2 months. Left solid; slight bulging and a small opening admitting the index finger, situated on the right side behind the external ring, just at the edge of the outer border of the rectus muscle.

*Slight Weakness in the Scar. Halsted's Operation. Wounds Suppurating, 3 Cases—Nos. 8, 11 and 32.*

In these three cases there is a small bulging and impulse over a small area in that part of the wound which was opened for suppuration and healed from the bottom by granulation. It consists of a stretching of the scar tissue; there is no opening. The results, so far as the comfort of the patient is concerned, are perfect.

(1). Case No. 8. Age 27 years. Wound closed with silk; healing per primam. Three weeks after discharge a single stitch abscess opened. Examination 3 years and 8 months after operation. In the scar (upper third), corresponding to the position of the abscess, there is a slight bulging and impulse. The patient had not noticed this. January, 1897, 6 years and 4 months, the patient writes that the result is a perfect one. April, 1899, examination. The swelling is a recurrence. See history.

(2). Case No. 11. Age 20 years. Wound closed with silk. At the end of the third week the upper third of the wound was opened because of a stitch abscess. Examination 8 months after operation. There is a bulging and impulse in the upper angle of the wound, but no opening. The patient considers the result a perfect one. Examination May, 1892, 1 year and 8 months after operation. There has been no increase in the bulging. December, 1897, the patient cannot be found.

(3). Case 32. Age 29 years. Wound closed with silk. On the fifth day the upper half of the wound was opened because of infection; healing in 6 weeks. Examination after 6 months: The scar of the upper half of the wound has stretched and there is a small bulging and impulse. The patient considers the result a perfect one. Since this date there have been frequent examina-

tions, the last in August, 1897, 5 years and 10 months after operation. The weak place has not increased in size. Practically the result is a perfect one. This patient is very thin and of very poor muscular development, and shows the "lateral bulgings of the abdominal wall met with in subjects of hernia" (see Treves' System of Surgery, vol. ii, 1896, p. 671, fig. 794). This is the only case observed by us showing this condition in a marked degree.

*Summary.—Ultimate Results in the Typical Halsted Operation.*

Considering only the 195 cases whose ultimate result is known from six months to nine years, wound healing per primam or suppurating, there have been 11 recurrences (5.6 per cent)—eight at the position of the transplanted cord (4.1 per cent), and three in the lower angle of the wound (1.5 per cent). The eight recurrences at the position of the cord have all been observed after operation in which the *veins were not excised* (86 cases, 9.3 per cent). In seven, the recurrence was found within three to six months after operation; in one, after four years (Case No. 6). **IN 109 CASES IN WHICH THE VEINS WERE EXCISED THE WOUND IN EVERY CASE AT THE POSITION OF THE CORD IS SOLID.**

In one of the three recurrences in the lower angle of the wound, the conjoined tendon was obliterated (the rectus was not transplanted). This recurrence took place within three months. In two (both wounds suppurated) the recurrence did not take place until four and five years after operation; in both of these cases the conjoined tendon at the time of the first operation was wide and firm.

Note, June 1, 1899. Ten years' observation. Halsted's operation. Cord transplanted.

Since April, 1899, the following recurrences have been observed:

At the position of the transplanted cord. Veins not excised. Wound healing per primam.

Two cases. Nos. 28 and 231. Both of these patients have been operated on a second time. See history.

At the position of the transplanted cord. Veins not excised. Wound suppurating.

One case, No. 8.

In the lower angle of the wound; associated with obliteration of the conjoined tendon and in which, at the operation, the rectus muscle was not transplanted. One case, No. 141. Second operation. See history.

The results at the present date, June, 1899, are as follows. Observation 6 months to 10 years.

Veins excised. 118 cases (109 healing per primam and 9 suppurating). No recurrences at the position of the cord.

Veins not excised. 120 cases with 11 (9.2 per cent) recurrences at the position of the transplanted cord. Seven (6.4 per cent) in 109 cases healing per primam and four (36.3 per cent) in 11 cases healing by suppuration.

In the lower angle of the wound there have been 4 recurrences. Two associated with obliteration of the conjoined tendon and in which, at the operation, the rectus muscle was not transplanted. Cases Nos. 168 and 141. And two associated with suppuration of the wound. (Cases Nos. 22 and 94.)

Ultimate results, wounds healing per primam, 218 cases, 9 recurrences, 4.1 per cent.

Ultimate results, all cases, 238 cases, 15 recurrences, 6.2 per cent.

**SEC. VIII.—THE ULTIMATE RESULTS AFTER OPERATIONS IN WHICH THE CORD HAS NOT BEEN TRANSPLANTED OR HAS BEEN EXCISED, OR IN WHICH CASTRATION HAS BEEN DONE, AND THE REASONS FOR THE VARIATION FROM THE USUAL METHOD (GROUP I, CORD TRANSPLANTED).**

Group.	Cases.
II. Halsted's operation, cord was not transplanted	25
III. Cases in which the cord was excised	20
IV. Cases in which castration was performed	27
V. Inguinal hernia in the female	39
VII. Testicle replaced in the abdominal cavity (Cushing)	4
VIII. Bassini operation	2

*Group II.—Cord not transplanted, 25 cases.*

(a). In 15 cases the herniæ belong to Class a, in which the conjoined tendon is wide and firm.

The operation in these cases was similar to Halsted's except that the cord was not transplanted. All are perfect results (14 healed per primam, 1 suppurated).

The details of these 15 cases are as follows:

No. 2, boy, aet. 5 years. Small hernia recurrence in the upper angle of the wound 4 months after a McBurney operation (see Group VI, No. 4); operation 5-12-'90, Halsted; wound healed per primam, perfect result; letter 6 years and 9 months.

No. 3, adult. Small recurrent hernia 4 months after an operation at another hospital, in which the wound suppurred; 8-1-'92, Halsted. The wound healed per primam. A letter one year after operation (1893) reported a perfect result. Lost track of since this date.

Of the remaining 13 cases, 3 were large, 1 medium and 9 small herniæ; 12 cases healed per primam. In 1 case there was very slight suppuration. All are perfect results. In 7 cases, 1 to 4 years, and in 6 cases, 2 to 9 months, after operation.

In 5 of these fifteen cases the veins were excised, in 10 the veins were not excised (all small herniæ and the veins were not very large). Of the five cases in which the veins were excised, in three the vas deferens was torn from its attachment. A very marked epididymitis took place in each case and atrophy of the testicle in two. In two cases the method described in this paper was followed; epididymitis or atrophy of the testicle did not take place.

The perfect results in these 15 cases demonstrate that at least in small herniæ, in which the conjoined tendon is wide and firm, it is not necessary to transplant the cord, and our observations show that the veins may be excised with less danger of epididymitis if the vas deferens and its immediate vessels are not disturbed. Future observations may show that a cord reduced so much in size by the excision of the veins is not more likely to cause by its presence a recurrence in the lower than in the upper angle of the wound. In two recent cases, both large herniæ, I have simply excised the veins, leaving the remainder of the cord undisturbed and closing the wound as usual, dividing and transplanting the internal oblique in one case and transplanting the rectus in the other, because the conjoined tendon was obliterated. In two other cases I transplanted the veins but left the vas deferens undisturbed; this procedure divides a large cord into two small ones and at the same time preserves the veins. This method should be followed in all cases of hernia in which, during the dissection of a very adherent sac, it is impossible to avoid tearing the vas deferens from

its vascular attachments, and in cases of hernia in which it may be necessary to withdraw the testicle out of the scrotum. In these four cases epididymitis did not follow the operation.

(b). The details of the remaining 10 cases are as follows:

In five cases belonging to Class b, *conjoined tendon obliterated*, rectus muscle not transplanted, only two perfect results have followed. Case No. 9, veins not excised, a very large hernia in an old man in which the wound healed per primam, except that on the ninth day a small blood-clot in the lower angle of the wound broke down and discharged for several days. The result is a perfect one; August, 1898, 1 year and 8 months. In Case No. 11, veins excised, in which the wound healed per primam, the patient wrote in April, 1898, 1 year and 4 months after operation, that the result on the right side was a perfect one, but that a complete recurrence had taken place on the left side. This patient had been operated on for a large right and small left inguinal hernia; both wounds healed per primam. On the left side the cord was transplanted; see Group I, No. 168. Reported as a complete recurrence in the lower angle of the wound associated with the obliteration of the conjoined tendon.

In 3 cases, Nos. 1, 4 and 15, the herniæ have recurred. In Nos. 1 and 4, the wounds suppurated; the recurrences are complete. In No. 15, the wound healed per primam; the recurrence is partial. In these three cases the veins were not excised.

In 5 cases the rectus muscle was transplanted; 4 because the conjoined tendon was obliterated. These cases are recent operations, 3 to 6 months. (Operator Bloodgood.) All healed per primam, and are perfect results. These 5 cases were very large and difficult herniæ, and the ultimate results in these cases, if perfect, will be strong arguments in favor of the transplantation of the rectus muscle and the non-transplantation of the cord.

Note, June 1, 1899. The ultimate results in these 25 cases remain unchanged, and the time since operation is more than six months in every case.

#### *Recurrence. Group II.—Cord not transplanted.*

Conjoined tendon obliterated, veins not excised, rectus not transplanted.

(1). Case 1, age 38 years. Hernia very large, complete, indi-

rect, of 11 years' duration. The opening into the abdomen "admits four fingers," indicating the obliteration of the conjoined tendon. Operation a very difficult one. On the 12th day the lower third of the wound was opened because of infection; a stitch sinus (silk) persisted four months. One month later an impulse and bulging were noticed in the lower angle of the wound. At the end of two years the recurrent hernia had descended into the scrotum. Examination, 7 years 4 months after operation: The hernia has not increased in size since the examination of 5 years before. It is reducible and held in place by a truss. The opening into the abdominal cavity measures 3 x 4 cm., and is just above the arch of the pubes. The conjoined tendon is obliterated. Second operation (advised by the writer, who would have transplanted the rectus) refused.

(2). Case No. 4, age 33 years. Very large hernia and strangulated; of but 6 hours' duration, following immediately after injury to the groin. The sac contained the cæcum and appendix and a large part of the ileum. The appendix being contused was excised. The abdominal wall was infiltrated with extravasated blood and the conjoined tendon was torn. The wound (closed with silk) was completely opened on the 9th day, being distended with blood. Healing in 5 weeks; all the sutures discharged. Three weeks after leaving the hospital (while at work) the patient felt something give way in the groin and immediately the rupture descended into the scrotum. Examination May, 1897, 2 years after operation: There is a very large, reducible hernia which descends into the scrotum. The opening is situated just above the arch of the pubes and is 3 x 3 cm. in diameter. The conjoined tendon is obliterated. Operation advised but refused by the patient.

(3). Case No. 15, æt. 53 years. Large, left inguinal hernia, strangulated 48 hours. Operation 7-12-'97 (Cushing); cocaine; the conjoined tendon was obliterated. Wound closed with silver wire. The approximation was not very satisfactory, but the condition of the patient contra-indicated ether. Healing per primam. Second operation 16-2-'98—6 weeks—because of a distinct bulging and impulse in the lower angle of the scar and because of a small, right inguinal hernia of the direct variety. Conjoined tendon right side not obliterated, but very narrow. Anaesthetic, ether. Right side, Group I. Halsted's operation with transplantation of the

rectus muscle; left side, Group VII, testicle replaced in the abdominal cavity. Both wounds healed per primam. In 2 months the replaced testicle forced its way down between the rectus and internal oblique muscle. Third operation 4-6-'98 (Cushing), ether. Group IV, No. 26. Castration. Wound closed with silver. Rectus muscle transplanted. Wound healed p. p. Examination June 1, 1899. Both wounds absolutely solid; 11 months since operation of the left side and 13 months since operation of the right side.

*Group III.—Cord excised, 20 Cases.*

In 3 cases, Nos. 1, 2 and 3, the cord was injured during the dissection. In Cases Nos. 1 and 2, the cord was very adherent to the sac. In Case No. 3 it was accidentally cut. In 2 cases, Nos. 13 and 17, the testicle atrophied, but the patient did not wish its removal, and there was no reason to preserve the integrity of the cord. In 15 cases the cord was deliberately excised. In Cases Nos. 8 and 15 the ages of the patients were 34 years and 46 years, respectively. The hernia in Case No. 8 was a recurrence after operation in which the wound had healed p. p. In Case No. 15 the hernia was of great size. The remaining 13 cases were old men, between the ages of 54 and 84 years. In 7 cases the hernia was large and in 6 cases small. In 3 cases the operation was done under cocaine—Nos. 16 and 18, both æt. 67 years, and No. 20, æt. 84 years.

In Case No. 18 the rectus muscle was transplanted. In Case No. 19, because of a recurrence at the position of the cord (Group I, No. 196), the entire cord was excised at the second operation. The result is a perfect one, January, 1899, four months since operation. The recurrence took place within three months after the first operation. The age of this patient was 53 years. For the immediate and ultimate condition of the testicle in these 20 cases, see Sect. XX.

*Group IV.—Cases in which the Testicle, together with the Vas Deferens and Veins, was removed at the Time of Operation for Hernia. Number of Cases, 27.*

In 2 cases, Nos. 1 and 14, boys aged 8 and 4 years, respectively, the testicle was excised on account of injury to the cord. In Case No. 1 the hernia was small and operation not difficult. In Case

No. 14 the hernia was of very great size. In 8 cases the testicle was excised because undescended and associated with a congenital hernia; in 8 cases on account of very large reducible herniae in old men, and in 4 on account of very large strangulated herniae in old men. In 2 cases double castration was performed for enlarged prostate, and at the same time a large reducible hernia on the right side was operated upon in 1 case because the testicle was atrophied; in 1 case because the sac was the seat of tuberculosis infiltrating the cord and testicle. In Case No. 7 the cord had been transplanted, but the night after the operation the testicle was found to be drawn up into the groin and could not be replaced; for this reason it was removed on the 3rd day. Age of patient, 46 years.

*The Treatment of Undescended Testicle associated with Herniae.*

In some of the cases of undescended testicle, excision of testicle is justifiable. To transplant such a testicle down into the scrotum is a difficult, and perhaps in some cases an impossible, procedure, and, as a rule, the testicle is undeveloped and functionless; at least as far as procreation is concerned. In all the cases of removal of undescended testicles (recorded in this paper) the testicle was undeveloped. A number were examined microscopically.

A few years ago Dr. Halsted suggested that undescended testicles causing hernia should be returned to the abdominal cavity or in some way preserved to the individual, believing these undeveloped organs were important in the economy of the male. Griffiths, too, believes that the preservation of even the non-developed testicles in a child may be of great value in the metabolism of development, and his experiments on animals conclusively prove that an undescended testicle, although it may be devoid of power of producing spermatozoa, yet it is of essential importance before puberty in the development of other organs of the genital apparatus, and of the male characteristics. (*Lancet*, March, 1895.)

We have never in a child removed both undescended testicles associated with hernia. Among our 9 cases, in 6 the undescended testicle was present on one side only. In one case (a child) both testicles were undescended, but the operation for hernia was performed only on one side. In a second case in which both testicles were undescended, there was also a double hernia; patient was 43 years of age. In this case both testicles (sterile) were removed

during the operation for hernia. In this patient the male characteristics and the other organs of the genitalia were fully developed. Since the operation, 4 years ago, he has noticed no change in his sexual power.

We have not as yet, since the suggestion of Dr. Halsted, had an opportunity in case of inguinal hernia associated with undescended testicle in a child to attempt to replace the testicle into the abdomen. A few months ago the writer succeeded without difficulty in transplanting down into the scrotum an undescended and undeveloped testicle, and at the same time preserving the integrity of the cord. The patient was a youth, aged 20 years (see Group I, Case No. 205). The result so far has been most satisfactory. This was done at the request of the patient, although the opposite testicle was in place and normal in size. The cord was preserved and transplanted, for I feared that ligation and excision might be followed by necrosis of the testicle. The testicle in this case was held in place in the scrotum by sutures. There was no swelling nor tenderness following the operation. It did not hang as low as its fellow, but its upper border is just below the lower border of the symphysis pubis.

Note, August, 1898. The writer some three weeks ago operated on a second case, transplanting the testicle which was situated in the abdomen, down into the scrotum. The hernia associated with the non-descent of the testicle was a very large one; see Group II, Case No. 21.

The case demonstrated the possibility of transplanting even a testicle from the abdominal cavity down into the scrotum without much difficulty.

Note, March 1, 1898. Dr. Harvey W. Cushing, the resident surgeon of the hospital, demonstrated 3 months ago that the non-developed and the fully developed testicle can be easily replaced in the abdominal cavity between transversalis fascia and peritoneum and the wound closed as in the ordinary operation for hernia in which the cord has been excised. In two cases he has replaced behind the abdominal wall the non-developed and undescended testicle associated with a congenital hernia. In each of these cases, both adults, the operation was performed only on one side, there being no indication for the same procedure on the other side. In two adult cases, with fully developed testicles, he followed the same procedure on one side. In these 4 cases the wounds healed per primam and the patients have complained of no pain or inconvenience.

The operation is a very simple one: after the excision of the sac and closure of the opening into the peritoneal cavity, the testicle and cord are freed from their attachments and placed in the iliac fossa outside of the peritoneum and the wound closed in the ordinary way.

In a child with undescended testicles (if they cannot be transplanted into the scrotum) this is a very important procedure and should probably

always be done rather than castration, especially if the operation is performed on both sides.

The two cases in which the normal testicle was returned to the abdomen have both recurred in a few months after operation and have been operated on again by Dr. Cushing. In one case, the younger man, the testicle was replaced in the scrotum; it is situated much higher than its fellow; as yet there is no positive evidence that its first replacement caused atrophy.<sup>1</sup>

In the other case, whose age was 53 years, the testicle was removed.

The other two cases so far are perfect results. December, 1898, eleven months since operation.

#### *Injury to the Cord during Operation.*

Injury to the vas deferens during operation has taken place in 5 cases. In 2 of these castration was performed. In 3 cases the cord was excised. These 5 cases occurred among the first 50 operations for hernia; 4 were very difficult cases.

#### *Retraction of the Testicle after Operation.*

A temporary retraction of the testicle after Halsted's operation was observed in 4 cases among 269 operations. In 1 case (already mentioned) in which the retraction was most marked, the testicle was drawn up beneath the skin over the pubes. In this case (an adult) it was removed with patient's consent, although, judging from the other cases, the probabilities are that it would have returned in time to its place in the scrotum. In the second case (a child) the testicle was retracted up to the level of the symphysis pubis. In about three months after operation it returned to its normal position, and at the last examination (3 years after operation) the testicle was normal in size and was in its proper position. In the third case, it was noted at the operation, before the wound was closed, that the testicle had a tendency to retract; for this reason it was sutured into its place in the scrotum. The ultimate result (3 years after operation) has been perfect. In the 4th case, a congenital hernia, the operator had difficulty in replacing the testicle down into the scrotum, and after the operation it hung close to the symphysis pubis. The last examination, December, 1897 (4 months after operation), it is found to hang almost as low as its fellow and is normal in size. In 2 of these 4 cases before operation the testicle on the operated side hung a little higher than its fellow.

<sup>1</sup> January, 1899. The testicle has atrophied.

*The Indication for the Excision of the Cord or Castration.*

If the testicle on the hernia side is atrophied and in the scrotum, there is no reason to preserve the cord; it should be excised or the testicle removed, according to the age and wishes of the patient.

If a non-developed and undescended testicle is transplanted down into the scrotum, the cord should be preserved. Necrosis of the testicle would probably follow the excision of the cord. In one case the writer transplanted the cord, in the second he did not. Both have been perfect results.

In old men it is inadvisable to weaken the wound by the presence of the cord; because if the veins are not excised the probabilities of a recurrence at its position are 9 per cent. If the hernia is small and during the operation the testicle does not have to be withdrawn from the scrotum, ligation and excision of the cord should be done. The mutilation of castration is avoided and epididymitis does not, as a rule, follow.

If the hernia is large and the sac adherent to the testicle and the dissection difficult, the testicle should either be removed or the cord preserved; the ligation and excision will be followed either by a haematoma (4 cases) or a marked epididymitis (3 cases) or necrosis (1 case), see Sec. XX.

In old men to excise the large hernia sac with cord and testicle in one piece is a very simple operation. The writer in one case did this under cocaine. There was also a very large hydrocele. The patient's age was 83 years (see Group IV, No. 26). The wound healed per primam (see photographs Nos. 1 and 2).

*Ultimate Results in Groups III and IV. These Two Groups can be Studied Together, because in Both the Problem of the Cord is Eliminated.*

(a). Per primam wound healing.

Group III, 17 cases; Group IV, 25 cases; total, 42 cases.

Perfect results, 37 cases.

Lost track of, 2 cases.

Death after operation, 1 case.

Complete recurrence, 1 case (Group III, No. 5).

Partial recurrence, 1 case (Group III, No. 12).

These two recurrences are situated in the lower angle of the wound and associated with the obliteration of the conjoined tendon.

The perfect results are divided according to year as follows:

9 years,	1 case.	1 year,	13 cases.
4 "	3 cases.	6 months,	2 "
3 "	7 "	Recent,	8 "
2 "	3 "		

(b). Wound suppurating.

Group III, 3 cases; Group IV, 2 cases.

Perfect results, 3 cases (5 years, 1 case; 3 years, 1 case, 1 year, 1 case).

Lost track of, 1 case.

Slight weakness in scar, 1 case (Group III, No. 6).

Considering the 46 cases which survived in these two groups, 40 belong to Class a, in which the conjoined tendon is wide and firm. Very large herniæ, 6 cases; large, 10 cases; medium, 4 cases; small, 21 cases. All are perfect results. In Case No. 6, Group III, in which the wound suppurated, there is slight bulging, but no opening in the upper angle of the wound. 6 cases belong to Class b, in which the conjoined tendon is obliterated. In four cases the rectus muscle was not transplanted; two have recurred (Group III, Nos. 5 and 12); one has been lost sight of, and one (Group III, No. 15) is a perfect result, 1 year and 3 months after operation. In two cases the rectus was transplanted; both are perfect results, but recent cases.<sup>1</sup>

The details of the cases in which *recurrences* occurred are as follows:

(1). Group III, Case No. 5. Age 58 years. Medium, right inguinal hernia, reducible, incomplete, acquired, direct, of 3 years' duration. Operation 16-11-'93 (Halsted). Closed with silk. Cord excised; conjoined tendon obliterated. Examination after 8 months showed a split in Poupart's ligament 1 cm. long, situated 1.5 cm. above the spine of the pubes; no bulging, no impulse. Examination after 1 year 3 months showed a slight bulging and impulse in the lower angle of the wound. Examined after 2 years, no change. Examined January, '97, after 3 years 1 month: The bulging has increased, the recurrent hernia is as large as the original hernia, and the protrusion comes through the split in Poupart's ligament noted 8 months after operation. This split is slightly

<sup>1</sup> March 1, 1899. No other recurrences in Groups III and IV have been observed.

larger; the hernia is reducible and the patient wears a truss. March, 1897, and December, 1897, after 4 years 2 months, examination shows that there has been no increase in size since the examination in January, 1897, 11 months ago. This patient has an inguinal hernia on the left side of equal size, and the conjoined tendon is also obliterated.

September 1, 1898. Examination; no change. Second operation advised, under cocaine.

(2). Group III, Case No. 12. Age 64 years; colored. Very large, right inguinal hernia, incomplete, direct, of 38 years' duration, strangulated 3 days. Although the hernia did not descend into the scrotum (a peculiarity common to almost all direct herniae due to the infundibuliform fascia preventing it or at least not forming a canal for its descent, as in the indirect variety), it is very large. Operation 12-4-'96 (Bloodgood). Closed with silver wire. The operator recognizing the absence of the conjoined tendon, sutured all the available tissue well down to the pubic bone, including *the sheath of the rectus*. This case would have been a proper one for the transplantation of the rectus, and it was the observation of the recurrence in this case that led the writer to attempt to get more tissue and muscle, if possible, to strengthen this lower portion of the wound, because he was convinced that he had sutured in this case all the available tissue, as in the usual operation for hernia. January, 1897, 8 months after operation, the patient wrote that the result was a perfect one, and that he was able to do his farm-work better than ever before.

The writer, wishing to be certain of the result in this difficult case, paid the expenses of the patient to come from the country for an examination, which he did January 27th, 1897. When the patient stands or coughs no bulging or impulse can be seen in the abdominal wall, but on inserting the finger, by invagination of the scrotum, into the external ring, an opening could be made out just above the arch of the pubes. It just admitted the tip of the index finger, and when the patient coughs there is a slight bulging and impulse. This condition perhaps might not be called a recurrence. Nevertheless, there is a distinct opening and impulse, which may become larger. The remainder of the wound is solid. In October, 1897, 1 year and 6 months after operation, the patient and his physician, who had examined him, both wrote that the wound is solid and that the result is a perfect one.

The case demonstrates that one can be certain of the correct result only by a personal examination. A letter reports the death of this patient a few weeks ago in consequence of a severe injury.

Slight weakness in scar, 1 case. Group III, No. 6. Age 69 years. Wound closed with silk; opened within 24 hours because of its distention with blood; complete healing in five weeks; only one suture (the lowest) discharged. Examination 2 months after operation. Between the outer third of the wound and Poupart's ligament there is a bulging 3 x 3 cm. This swelling is not reducible. The impulse is not more marked than over the remainder of the abdominal wall. There is no discomfort. The patient has been examined at intervals since; last examination September, 1897, 3 years and 9 months after operation: There has been no change in the bulging. The result is practically a perfect one. January, 1899. 5 years. Examination, no change.

*Note, June 1, 1899.* In one case, Group III, No. 15, in which the entire wound was opened for suppuration, a slight recurrence has just been noted in the upper angle (see history).

#### *Group V.—Inguinal Hernia in the Female, 39 Cases.*

In 20 cases the round ligament was excised and the internal oblique muscle divided and transplanted (drawn down to line the wound). In 6 cases the ligament was excised but the muscle not divided. In 3 cases the round ligament was not disturbed but the internal oblique muscle was divided and transplanted. In 5 cases the round ligament was not disturbed and internal oblique muscle was not divided. In 2 cases the writer transplanted the round ligament and vessels up into the angle of the divided internal oblique muscle, by the same procedure as that employed in the male. Although we have no observation that the excision of the round ligament is followed by any serious results, yet there seems to be no good reasons why it should not be preserved and treated like the cord in the male. In 2 cases the rectus muscle was transplanted (Nos. 31 and 36). In 1 case the bladder was opened by mistake (No. 6); and in this case, after suturing the wound in the bladder, the laparotomy wound was drained with gauze.

Ultimate results. Group V.

Group A. Wounds healing per primam, 34 cases.

Lost, 11 cases.

Death, 1 case.

Recurrence, 1 case, Nos. 14 and 18 (same patient).

Perfect results, 21 cases. (Examined, 13; letter, 8 cases.) 3 to 8 years, 6 cases; 2 years, 3 cases, 1 year, 9 cases; recent, 3 cases.

Group B. Wound suppuration.

4 cases, 3 in which the wound suppurred (Nos. 12, 17, 22). 1 in which the wound was left open (No. 6). All perfect results. 7 years, 4 years, 3 years and 2 years.

Of these 38 cases, 37 belong to Class a, in which the conjoined tendon is wide and firm. 1 was classed as a very large hernia; 2 as large and 34 as small herniæ. The one recurrence which has taken place in this group is situated in the outer angle of the wound through a split in the aponeurosis of the external oblique muscle.

One case, No. 31, belongs to Class b, in which the conjoined tendon was obliterated, the rectus muscle was transplanted; the result is a perfect one, 1 year and 3 months after operation.<sup>1</sup>

#### *The Recurrence in Group V.*

Case No. 14. Age 31 years. Large, reducible, complete, indirect, left inguinal hernia of 13 years' duration. Patient had a very fat abdominal wall. Operation 10-3-'94 (Halsted). The opening into the abdominal cavity was large, due to the high position of the internal oblique muscle, which was very thin. *The conjoined tendon was not obliterated.* There was little else to suture except the aponeurosis of the external oblique. Wound closed with silver wire. Examination 7 months after operation showed below the middle third of the scar a split in the aponeurosis of the external oblique 3 cm. long. Through the opening a slight impulse and bulging can be felt. One year later this had enlarged. Second operation 21-5-'95 (Bloodgood), 1 year and 2 months after the first operation. The opening was situated in the aponeurosis of the external oblique and measured 3 x 2 cm. in diameter; the edges were thickened to 5 mm. by scar tissue. No muscular tissue could be found. The sac was excised and the aponeurosis sutured with silver wire; healing p. p. In six months a second and similar recurrence took place. This had not increased in size at the end of one year (May, 1896). At the present date (December, 1897) the patient cannot be found.

<sup>1</sup> June 1, 1899. No other recurrences have been observed in Group V.

"The result in this case strengthens our belief in the necessity for muscle to line laparotomy wounds; the absence of muscle in this case probably caused the recurrence" (Dr. Halsted). Were the writer to operate again on this patient he would transplant the rectus muscle.

The problems in operations for inguinal herniæ in the female are then much more simple than in the male. The cord is much smaller, due chiefly to the smaller number and size of the vessels, and for this reason the cord may either be left in place or transplanted. Herniæ have been reported to have taken place after the Alexander operation, and are due more to the faulty suture of the wound than to the cord itself.

In the female the obliteration of the conjoined tendon must be a very rare condition (1 in 38). The writer in four recent operations and at six autopsies has made a very careful examination of the tendon, and in each instance found the tendon to be wider than in the male, extending out to the deep epigastric vessels.

#### *Group VI.—McBurney's Operation, 7 Cases.*

The operator in each case was Dr. Brockway, resident surgeon of the Hospital from June, 1889, to 1890. Of the 7 cases, 1 has been lost sight of (No. 2, adult). Partial recurrence occurred in 3 cases (Nos. 4, 5 and 7). The recurrent hernia in these 3 cases took place within 5 to 8 months after operation. In each case the opening and bulging is situated to the outer side of the conjoined tendon, and does not descend into the scrotum. Case No. 5 was an adult, aged 45 years. At the last examination, March, 1897 (7 years after operation), there has been no increase in size in the recurrent hernia, and the patient has worn a truss with comfort. Case No. 4, a boy, aged 5 years, was operated on again (see Group II, Case No. 2); the wound was closed with silk, but the cord was not transplanted. The wound healed per primam and the ultimate result is a perfect one (5 years after operation). Case No. 7, aged 5 years, wears a truss, and a letter dated January, 1897 (6 years and 4 months after operation), states that the boy, who is now eleven years old, still wears a truss; this patient has never been examined since the third month after operation, when the recurrence was noted. (THESE TWO CASES (MCBURNEY'S OPERATION) REPRESENT THE ONLY RECURRENCES

AMONG 68 OPERATIONS FOR INGUINAL HERNIA ON CHILDREN, BETWEEN THE AGES OF 1 AND 15 YEARS.) Perfect results, 3 cases, all small herniæ in children, in which the conjoined tendon was wide and firm.

*Group VII.—Cases in which the Testicle had been replaced in the Abdominal Cavity, 4 Cases.*

In these cases it was Dr. Cushing's object to preserve the testicle and at the same time eliminate the problem of the cord. The wound was closed similar to those in which the cord had been excised or castration performed. Perfect results, 2 cases; adults, æt. 26 and 46 years. Small hernia associated with undescended testicle, in one case of the right side, in the other of the left side. Both wounds healed per primam. In one case the rectus muscle was transplanted. Last examination August, 1898, 7 and 8 months since operation. (June, 1899, perfect results.)

Recurrences in two cases; both adults; testicle normal and in the scrotum.

Case No. 4. Æt. 53. Slight recurrence; see Group II, Case No. 15. The hernia in the first instance was strangulated, and the operation was performed under cocaine. The wound healed per primam. 6 weeks later the second operation was performed, the testicle replaced and the rectus muscle transplanted. The wound healed per primam. At the second operation a hernia on the right side was operated on. See Group I, Halsted's operation No. 221, the rectus muscle was transplanted, the wound healed per primam. Six weeks after the second operation the patient noticed a bulging on the left side. On examination it was found that the testicle was forcing its way down between the outer border of the rectus and the internal oblique. Third operation 4-6-'98; castration; rectus transplanted. Wound closed with silver wire, healing per primam. December 20, 1898, 6 months, both wounds absolutely solid.

Case No. 2. Æt. 37. Large hernia; conjoined tendon not obliterated. Operation 21-12-'97. Testicle replaced. Wound closed with silver wire. Rectus muscle not transplanted. Healing p. p. A similar recurrence took place in three months, due to the descent of the testicle. Second operation 11-5-'98. Testicle replaced into the scrotum. Halsted operation, Group I, Case No. 237; the rectus muscle was transplanted; healing per primam. August 20, 1898,  $3\frac{1}{2}$  months, wound solid.

*Group VIII.—Bassini Operation, 2 Cases.*

Medium size hernia, child, æt. 5 years. Operation (Cushing) April, 1898. August, 1898,  $4\frac{1}{2}$  months, perfect result, and a strangulated hernia in an adult, a very recent case. (June, 1899, both perfect results.)

**SEC. IX.—THE PROBLEMS IN THE OPERATION FOR INGUINAL HERNIA,  
WITH THE SPECIAL CONSIDERATION OF THE OBLITERATION OF THE  
CONJOINED TENDON (A FACTOR, PERHAPS THE CHIEF FACTOR,  
AMONG THE CAUSES OF THE RECURRENCE OF THE HERNIA) AND  
OF THE TRANSPLANTATION OF THE RECTUS MUSCLE TO OVERCOME  
THIS DEFECT.<sup>1</sup>**

In the previous sections the ultimate results of the operation for inguinal hernia (394 cases) were considered under the different Groups I to VIII, in which the radical operation differed in regard to the treatment of the cord. The recurrences in each group were given in detail. We are now prepared to summarize the ultimate results and group the cases of recurrence according to their position and probable cause, first describing the condition heretofore spoken of as the obliteration of the palpable portion of the conjoined tendon.

The term "obliterated" is used because the extreme condition is more likely to be acquired than congenital. Undoubtedly the conjoined tendon may be congenitally very narrow or very attenuated. However, the important point to be recognized at the operation is that the conjoined tendon in these cases is either obliterated, very narrow, or very attenuated, and that the lower angle of the inguinal canal (Hesselbach's triangle) has lost its strongest support (the conjoined tendon), and that something (the transplanted rectus muscle) must be substituted for this defect at the operation for hernia.

<sup>1</sup> A preliminary report of this section was read at the 100th Annual Meeting of the Medical and Chirurgical Faculty of Maryland, in Baltimore, April 28, 1898, and has been published in the Maryland Medical Journal for May 7, 1898, and in The Johns Hopkins Hospital Bulletin, vol. ix, No. 86, May, 1898. The first operation was performed by the writer in April, 1897.

*A Description of what is meant by the Obliteration of the Palpable Portion of the Conjoined Tendon in Cases of Inguinal Hernia.*

On making a careful study of inguinal hernia the writer has been impressed with the fact that they may be divided into two classes; the larger class (*a*) includes the cases in which the conjoined tendon is wide and firm, and the second, a much smaller class (*b*), includes the cases in which the conjoined tendon is practically completely obliterated.

*Class a.* In those cases of inguinal hernia in which the tendon is present it is easily discoverable before and demonstrable during the operation. If one inserts the index finger into the external ring, by invaginating the scrotum, the finger meets, after passing the pillars of the ring, a firm wall of tissue, the conjoined tendon, and it is to the outer side of the outer border of this tendon that the finger feels the impulse of the inguinal hernia. At the operation, if one examines the posterior wall of the inguinal canal, this tendon, if present, will be found to extend from the outer border of the rectus muscle to within about 1 cm. of the deep epigastric vessels. In some cases it may be wider, in other cases narrower. This tendon is clearly shown in Quain's Anatomy, 10th edition, Appendix, Fig. 23, p. 52. In Quain's Anatomy it is described as follows (p. 55): "At the part of the abdominal wall through which the direct inguinal hernia finds its way there is recognized on its posterior aspect a triangular interval, the sides of which are formed by the epigastric artery and the margin of the rectus muscle, and the base by Poupart's ligament. It is commonly called the triangle of Hesselbach. The triangle measures about two inches (5 cm.) from above down, and an inch and a half (3.5 cm.) transversely at its base. In this area the abdominal wall consists of, besides the integuments, 1. the aponeurosis of the external oblique muscle, which is perforated toward the lower and inner corner of the space by the external abdominal ring; 2. the inner portion of the cremaster muscle covering the spermatic cord at the lower and outer part of the space, and above this, the lower fibres of the internal oblique and transversalis muscles passing to their insertion *by the conjoined tendon, which, as a rule, extends over the inner two-thirds of the lower part of the triangle;* 3. transversalis fascia; 4. subperitoneal tissue, and 5. peritoneum."

"The conjoined tendon varies greatly in its development. In

many cases it is very slight and scarcely to be distinguished, while in others its deeper portion, derived from the transversalis muscle, covers the whole breadth of the triangle, reaching outwards along the deep femoral arch as far as the internal abdominal ring."

The observations by the writer on the variations in the width of the conjoined tendon and its complete obliteration in some cases were made without the knowledge of the statement just quoted in Quain's Anatomy, and he was very glad to find a confirmation of his observations. The writer is not familiar with any other surgeon or anatomist who has dwelt upon the importance of the *obliteration* of the conjoined tendon as the chief cause of recurrence in these cases of hernia.<sup>1</sup>

In cases of hernia in which the conjoined tendon is wide and firm the rupture takes place between the outer border of the tendon and internal oblique muscle. It may be either of the direct or indirect variety. It then extends down along the inguinal canal and protrudes from the external ring. In these cases the problem is a simple one; it is only necessary to suture muscular tissues down to or just beyond the outer border of the tendon. There is no tendency to recur in the lower angle of the wound just above the pubes and to the outer side of the outer border of the rectus, when at this position the protrusion of the peritoneum is prevented by the conjoined tendon. If one does not transplant the cord a hernia may take place along the cord, protruding between the outer border of the conjoined tendon and sutured tissues. If one transplants the cord and lines the wound with muscle, the probability of a recurrence at this position (the lower angle), at least as far as our cases are concerned, is practically nil.

*Class b.* In cases in which the conjoined tendon is obliterated, the finger does not meet any obstruction after passing through the external ring, but can be introduced without difficulty into the abdominal cavity for some distance; in this position, the finger feels the sheath of the rectus muscle to the medial side; by curving the finger downwards and backwards the posterior surface of the symphysis pubis can be easily palpated. The opening into the

<sup>1</sup> It has been possible to make this observation only within the last few years or since the operations of Halsted and Bassini have made the radical cure of hernia so certain. Prior to these operations, recurrences took place regularly alongside of the cord in the inguinal canal.

abdominal cavity extends in these cases from the outer border of the rectus and from the arch of the pubes upwards and outwards to the internal oblique muscle. Before operation the number of fingers which can be introduced is limited by the size of the external abdominal ring. In some cases it is but one finger, in others two or more fingers. At the operation, however, after the division of the aponeurosis of the external oblique from the position of the external ring upwards, one can usually introduce the entire hand into the abdominal cavity; in these cases the conjoined tendon is, as I have said, either thin and relaxed or completely obliterated, and the posterior wall of the inguinal canal from the outer border of the rectus upwards and outwards to the internal oblique muscle, and downwards and outwards to Poupart's and Gimbernat's ligament, is formed only by thin and easily stretched transversalis fascia and areolar tissue.

Before describing the method of and the reason for the transplantation of the rectus muscle in cases in which the conjoined tendon is obliterated, the writer will classify the results of the 277 operations in Groups I to V. This classification will clearly demonstrate that the obliteration of the conjoined tendon is the chief cause (55 per cent) of recurrences in the lower angle of the wound, whether the cord has been transplanted or not transplanted or excised. The figures will also demonstrate that the presence of the cord in the upper angle of the wound has been the cause of a few recurrences (9.3 per cent), *but only in those cases in which the veins were not excised.* The suppuration of the wound has increased the probabilities of a recurrence.

In view of the fact that the great majority of the 16 cases of recurrence took place between 1 and 8 months after operation, we have included all cases between 6 months and 9 years whose ultimate result is known. More recent cases and cases lost track of since the operation are not included. The time after operation in which the recurrences have taken place in these 16 cases is as follows: 13 cases, 1 to 8 months (2 within 1 month; 2 within 4 months; 3 within 6, 7 and 8 months); 3 cases, 4 to 5 years. In one of these cases it seems very likely that the slight weakness at the position of the cord took place within the first year; it was not noted until the examination 4 years after operation.

*I. The probabilities of a recurrence at the position of the trans-*

*planted cord.* (Only cases whose ultimate result is known after six months are included.)

*Wounds healed per primam.* Veins excised, 100 cases (Halsted's operation, Group I)—91 cases from 1 to 7 years; 9 cases, 6 months to 1 year. In these 100 cases there is not one recurrence at the position of the cord. In one case (No. 168) there is a complete recurrence at the lower angle of the wound associated with the obliteration of the conjoined tendon, but at the position of the cord the wound is solid. In Case No. 51 the scar has stretched.

*Wounds suppurated.* Veins excised, 9 cases (Halsted's operation)—8 cases, 1 to 7 years; 1 case, 6 months to 1 year. In not one case is there a recurrence or weakness at the position of the transplanted cord. In one case (No. 94) there is a slight recurrence at the lower angle of the wound.

These figures demonstrate that IN 109 CASES OF HALSTED'S OPERATION IN WHICH THE VEINS WERE EXCISED (99 cases, 1 to 7 years and 10 cases, 6 months to 1 year), THERE IS NOT A SINGLE CASE OF WEAKNESS OR A RECURRENCE AT THE POSITION OF THE TRANSPLANTED CORD. In two cases, less than 2 per cent, there have been recurrences at the lower angle of the wound.

*Wounds healed per primam.* Veins not excised, 75 cases (Group I, Halsted's operation, 74 cases; Group V, female, round ligament transplanted, 1 case)—48 cases, 1 to 8 years; 27 cases, 6 months to 1 year. In this group of 75 cases there have been 5 recurrences at the position of the transplanted cord (6 per cent), Nos. 6, 174, 176, 196 and 227. In Nos. 176 and 196 second operations were performed; 176 is a perfect result, 9 months since the second operation. The veins were not large in this case. The recurrence was coincident with an injury after operation (see history). In No. 196 the veins were very large. The second operation has been a recent one. The veins and vas deferens were excised. No. 6 is a very small affair and should hardly be considered a recurrence. It is nine years since the operation, and the patient considers himself cured. No. 174 wears an abdominal belt. Case No. 227 has just been observed, December, 1898.

*Wounds suppurating.* Veins not excised, 11 cases—8 cases, 1 to 9 years; 3 cases, 6 months to 1 year. Among these 11 cases there have been 3 recurrences (27 per cent) at the position of the cord, Nos. 2, 21 and 224. The sizes of the recurrent herniae are

similar to Nos. 176 and 196. None wear trusses, nor do they complain of any discomfort. Nos. 2 and 21 have not increased in size over a period of 4 and 8 years. No. 224 is a recent case. In one case (No. 22) a recurrence took place in the lower angle of the wound 5 years after operation.

Therefore, in a Halsted operation in which the *veins have not been excised*, wound healing per primam and wound suppurating, the probability of a recurrence at the position of the transplanted cord is 9 per cent (8 recurrences in 86 cases—42 cases, 1 to 9 years; 44 cases, 6 months to 1 year).

*II. The probability of a recurrence in the upper angle of the wound in cases in which the cord has been excised or not transplanted.*

Table Group.	Wounds healing p.p.	Recurrence.	Wounds sup.	Recurrence.
II Cord not transplanted	13	0	1	0
III Cord excised	10	0	3	0
IV Castration	21	0	1	0
V Female	18	1	4	0
	—	—	—	—
Total cases	62	1	9	0

62 cases healing per primam (57 cases, 1 to 9 years; 5 cases, 6 months to 1 year). 9 cases suppurated; all 1 to 9 years. Among these 71 cases there has been but one recurrence (1.4 per cent) in the upper angle of the wound (Case No. 14, Group V). In this case the recurrent hernia took place through a split in the aponeurosis of the external oblique; the wound healed per primam.

*III. The probability of a recurrence at the lower angle of the wound in cases (Class a) in which the conjoined tendon is wide and firm, and in which the rectus muscle was not transplanted.*

Table Group.	Wounds healing p.p.	Recurrence.	Wounds sup.	Recurrence.
I Cord transplanted	169	0	20	2
II Cord not transplanted	9	0	1	0
III Cord excised	18	0	2	0
IV Castration	19	0	1	0
V Females	17	0	4	0
	—	—	—	—
Total cases	232	0	28	2

Of these 232 cases which healed per primam, 175 are from 1 to 9 years and 47 cases, 6 months to 1 year after operation. There is

not one recurrence in the lower angle of the wound. This demonstrates that if the wound heals per primam and the conjoined tendon is wide and firm, the probability of a recurrence in the lower angle of the wound is nil. It should be noted here that in only 9 cases was the cord left in the lower angle of the wound.

In 28 cases (all 1 to 8 years) in which the wound suppurred, and in which the conjoined tendon was wide and firm, there have been recurrences in the lower angle in 2 cases (5 per cent). Group I, No. 22. Recurrence 5 years after operation, due to the "giving away" of the conjoined tendon after a severe illness with frequent attacks of coughing. Second operation. Group IV, No. 19. The result of the second operation is a perfect one. September, 1898, 1 year 4 months. At the second operation the rectus muscle was transplanted.

Case No. 94 has just been observed 4 years after operation, the rupture has taken place through a split in the conjoined tendon (see history).

*IV. The probabilities of a recurrence at the lower angle of the wound in cases (Class b) in which the conjoined tendon is obliterated and in which the rectus muscle was not transplanted.*

Table Group.		Wounds healing p.p.	Recur- rence.	Wounds sup.	Recur- rence.
I	Cord transplanted	3	1	0	0
II	Cord not transplanted	2	1	3	2
III	Cord excised	2	2	1	0
IV	Castration	0	0	0	0
V	Female	0	0	0	0
		—	—	—	—
	Total cases	7	4	4	2

In cases healing per primam the recurrences are 57 per cent; in wounds suppurring, 50 per cent; considering both, 55 per cent.

The six recurrences in this group are, with two exceptions, as large as the original hernia, and all took place within 6 weeks to 6 months. In Cases Nos. 1 and 4, Group II, the recurrent herniae descended into the scrotum; in these two cases three factors were present to account for the recurrence: the suppuration of the wound, the cord (veins not excised), and the obliteration of the conjoined tendon.

In Case No. 168, Group I, and Case No. 5, Group III, the

recurrent herniæ are as large as the original. In Case No. 12, Group III, and Case No. 15, Group II, the recurrent herniæ are smaller. In these four cases the wound healed per primam. In two the cord was excised, in one transplanted, and in one case not transplanted.

In one of the two cases in Group I (No. 7), recorded as a perfect result, there is not a distinct recurrence, but at the lower angle of the wound there is a slight impulse and bulging. *In only four cases are the results perfect.* Group I, No. 164, examined 8 months after operation, and heard from by letter 1 year and 9 months. Group II, No. 11, heard from by letter 8 months after operation. This patient was operated on for a double hernia, and wrote that a complete recurrence has taken place on the left side (Group I, No. 168). In these two cases the wound healed per primam. In two cases the wound suppurred. Group II, No. 9, writes (August, 1898, 1 year 8 months after the operation) that the result is a perfect one. Group III, No. 15, examined 1 year and 8 months after operation. Five cases have been lost track of since operation: Group I, Nos. 141, 172, 173 and 188, and Group II, No. 13.<sup>1</sup>

#### *The Transplantation of the Rectus Muscle in Cases in which the Conjoined Tendon is Obliterated.*

Impressed by the large proportion of recurrences in the *few cases* (6 recurrences in 11 cases) in which the conjoined tendon was obliterated, and with a hope of solving the additional problem presented by the obliteration of this tendon, the writer has devised, and in 12 cases performed a plastic operation on the rectus muscle, bringing this muscle down and suturing it with the other available tissues to Poupart's ligament and to the aponeurosis of the external oblique from the arch of the pubis up to the position of the transplanted cord. The procedure is a very simple one, and the inclusion of the transplanted rectus in this portion of the wound must add strength. In the past we have learned chiefly from the proper introduction and utilization of muscular tissue in laparotomy wounds. Every surgeon is familiar with the numerous herniæ after laparotomies in which the incision has been made in the

<sup>1</sup> May 20, 1899. Case No. 141 has just been examined for the first time since operation, 3 years ago. There is a recurrence in the lower angle of the wound, first noticed three weeks after operation (see history).

linea alba. In 4 of our own operations for umbilical hernia in which the fascia only had been sutured there have been 3 recurrences; in those cases in which the rectus muscle has been exposed and sutured there have been no recurrences. After a careful observation of all the laparotomies performed by us in this hospital for a period of over eight years, we find that there has been but one hernia in a laparotomy wound, which has healed per primam throughout, and in which muscle as well as fascia has been approximated. So impressed have we been with the importance of including muscle in the suture after laparotomy wounds that it is our rule in medium laparotomy to expose the inner border of the rectus muscle rather than cut through the linea alba, and to expose the outer border of the rectus rather than cut through the linea semilunaris; and Prof. Halsted in his original conception of his operation for inguinal hernia divided the internal oblique muscle with this object in view. He writes: "Fortunately we have muscles so near at hand and so placed as to suggest at once a simple and, what has proved to be, an entirely effective plastic operation." The writer therefore claims no originality whatever in the use of the muscle to strengthen the hernial wound, but simply the original idea of transplanting the rectus to strengthen the wound in certain cases of hernia.

The procedure is a very simple one; the method of operation, with this exception, is the same as that followed in the typical Halsted operation. Before inserting the deep sutures the sheath of the rectus muscle is exposed; this is easily done by retracting upwards and inwards the aponeurosis of the external oblique and internal oblique muscles. The sheath of the rectus is divided (Fig. 8b) in the direction of the muscle bundles from its insertion in the symphysis pubis upwards for a distance of 5 cm. After the division of the sheath the outer border of the belly of the muscle bulges out; it is caught with two or three sutures of heavy black silk, which are used as retractors to draw the muscle outwards and downwards. The operation at this stage is shown in Fig. 9. The deep sutures of silver wire are then inserted in exactly the same manner as described in Halsted's operation, with the addition that the four sutures below the transplanted cord include the *sheath* of the rectus and the *muscle* (Fig. 10); when these sutures are tied the rectus muscle is approximated to Poupart's ligament and the aponeurosis

of the external oblique, from a position just below the transplanted cord down to the symphysis pubis, in addition to the divided and transplanted internal oblique muscle. Figs. 8, 9, 10 and 11 clearly demonstrate that the transplanted rectus strengthens the lower portion of the wound, which has been weakened by the obliteration of the conjoined tendon, better than any other available tissue could do.

The writer had this idea in mind for over a year, but not until April, 1897, did a case present itself in which the conjoined tendon was obliterated and in which he considered it necessary to transplant the rectus.

These drawings were made by Mr. Max Brödel from careful dissection on the cadaver and from operations.

*V. Table of the ultimate results in cases in which the rectus muscle has been transplanted because the conjoined tendon was obliterated.*

Group.	Cases.
I Halsted's operation	6
II Cord not transplanted	4
IV Castration	3
V Female	1

The wounds in these 14 cases healed per primam. The operation in the first case (Group IV, No. 19) was performed April 23, 1897. The hernia was a recurrence in the lower angle of the wound due to the giving way of the conjoined tendon 5 years after operation (Group I, No. 22). The hernia was strangulated at the second operation and the scar tissue complicated the dissection. All this tissue was excised. The wound healed per primam and the ultimate result is a perfect one, December, 1898, 1 year and 8 months. Castration was performed on account of the age of this patient and the difficulty of dissecting the scar tissue from the cord and testicle.

The result in the second case (Group V, No. 31), a female, is a perfect one, September, 1898, 1 year and 4 months. In this case the method of the transplantation differed somewhat from the first case, which has been the one adopted (see history).

In the third case (Group I, No. 196) the result (August, 1898, 1 year) was a perfect one in the lower two-thirds of the wound. At the position of the transplanted cord there was a very slight recur-

rence; fortunately the patient consented to a second operation, and the writer was able to examine the scar. Second operation August 20, 1898. The opening was situated just above the cord; it admitted the index finger (1 cm.); the veins accompanying the cord were very large. The protrusion of the peritoneum forming the sac would about fit over the last phalanx of the index finger. The tissue about the transplanted cord was thick and strong scar tissue; the internal oblique muscle which had been divided and transplanted was converted into strong scar tissue. The muscle was separated by about 1 cm. of this tissue. The recurrence seemed distinctly due to the large bundle of veins (at least 1 cm. in diameter). The lower portion of the wound was solid. About 1 cm. of the outer border of the rectus seemed converted into scar tissue; the remainder of the muscle appeared unchanged. The rectus had remained in the transplanted position.

At the second operation the veins and cord were excised and the operator experienced no difficulty in including fresh surfaces of the rectus and the interior oblique muscles in closing the wound.

The remaining eleven cases are recent—4 months, 1 case; 3 months, 3 cases; 1 to 2 months, 6 cases. Ten cases were very large herniæ. One case was a recurrence due to the descent of the replaced testicle (Group VII, No. 2). All healed per primam and are perfect results.

June, 1899. These 14 cases have all been examined or heard from and are perfect results. The last reports were in September, nine months ago.

The comparison of the results in these 14 cases with the 11 cases in which the rectus were not transplanted is very suggestive of the importance of this procedure in operations for hernia in which the conjoined tendon is obliterated.

VI. In 16 operations the rectus muscle has been transplanted in cases in which the conjoined tendon was not obliterated. 15 cases healed per primam: Group I, 10 cases; Group II, III and V, each one case, and Group IV, 2 cases. All are perfect results; 8 cases, 6 months to 1 year; 7 cases recent. In one case (Group I, No. 224) the wound suppurated; 3 months after operation a slight recurrence took place at the position of the transplanted cord. The lower two-thirds of the wound is solid. The veins were *not* excised.

June, 1899. No other recurrence observed.

*Summary of the Ultimate Results. Complete to June 1, 1899.*

Recent cases less than 6 months and cases lost track of are not included.

All cases Group I to V healing p. p.	301	cases	13	rec.	4.3%
"    "    "    "    suppurating	31	"	9	"	29%
 Total	 332	"	 22	"	 6.6%
Halsted's opera., Group I, healing p. p.	218	cases	9	rec.	4.1%
"    "    "    "    suppurating	20	"	6	"	30%
 Total, Group I,	 238	"	 15	"	 6.2%
Group VI, McBurney's operation	6	cases	3	rec.	50%
Group VII, testicle replaced in the abdominal cavity	4	"	2	"	50%
Group VIII, Bassini's operation	2	"	0	"	nil.

*Summary of the Probabilities of Recurrence in Wounds Healing  
Per Primam.*

	Cases.	Recurrences.
(1) At the position of the transplanted cord, veins excised	109	nil.
(2) At the position of the transplanted cord, veins not excised	109	7 (6.4%)
(3) Upper angle of the wound, cord excised or not transplanted	83	1 (1.2%)
(4) Lower angle of the wound, Class a, con- joined tendon wide and firm, rectus muscle not transplanted	264	nil.
(5) Lower angle of the wound, Class b, con- joined tendon obliterated, rectus muscle not transplanted	8	5 (62%)
(6) Lower angle of the wound, Class b, con- joined tendon obliterated, rectus muscle transplanted	14	nil.
(7) Lower angle of the wound, Class a, con- joined tendon wide and firm, rectus mus- cle transplanted	16	nil.

*Summary of the Probabilities of Recurrence in Wounds Healing by Suppuration.*

	Cases.	Recurrences.
(1) At the position of the transplanted cord, veins excised	9	nil.
(2) At the position of the transplanted cord, veins not excised	11	4 (36.3%)
(3) Upper angle of the wound, cord excised or not transplanted	11	1 (9%)
(4) Lower angle of the wound, Class a, con- joined tendon wide and firm, rectus mus- cle not transplanted	27	2 (7.4%)
(5) Lower angle of the wound, Class b, con- joined tendon obliterated, rectus muscle not transplanted	4	2 (50%)
(6) Lower angle of the wound, Class b, con- joined tendon obliterated, rectus muscle transplanted	0	
(7) Lower angle of the wound, Class a, con- joined tendon wide and firm, rectus mus- cle transplanted	0	

Suppuration increases the probability but does not influence the position of the recurrence.

*Conclusion as to the operation for inguinal hernia.*

Our observations prove that Halsted's operation with the excision of the veins will give perfect results, except in those few cases in which the conjoined tendon is obliterated; in these cases our observations so far have demonstrated that the transplantation of the *rectus muscle* will give perfect results.

If the veins could be excised in every case of inguinal hernia and the remainder of the cord transplanted without any risk of epididymitis and atrophy of the testicle, a perfect result would probably be accomplished in every case.

The operation would then be: The ligation and excision of the veins, the transplantation of the remaining portion of the cord into the upper angle of the divided and transplanted internal oblique muscle, and, in cases in which the conjoined tendon is obliterated, the transplantation of the *rectus muscle*. So far we have not observed a single recurrence when these procedures have

been adopted. The sole objection to this method is the danger of atrophy of the testicle after excision of the veins. Atrophy of the testicle has been observed only after a very marked epididymitis. The probabilities of this epididymitis are very much less when the veins are excised without disturbing the vas deferens and its immediate vessels. For this reason I should advise that when the veins are excised the remainder of the cord, a very small affair, be left undisturbed. I am very much inclined to believe that the cord, reduced to such a diminutive size by the excision of the veins, will be as little likely to be the cause of a recurrence in the lower angle of the wound as in the upper angle when it is transplanted.

*Cases in which the Veins should not be Excised.*

When during the dissection of the sac the cord is torn from its bed in the inguinal canal and subjected to traumatism, and the testicle withdrawn from the serotum, the veins should not be excised, because the probabilities of epididymitis and atrophy are too great. In such cases I would advise the transplantation of the veins alone, so that the larger cord is divided, and the wound is weakened less by the presence of a very small cord in two places than by the presence of a larger cord in one place, which from our results we know to have been the cause of a recurrence in 6.4 per cent of cases.

Note, June, 1899. In October, 1898, I performed for the first time the splitting of the cord, transplanting the veins only. Since this date the modification has been followed in 26 operations for inguinal hernia. In 12 the rectus muscle was transplanted. The wounds in 25 cases healed per primam. In 19 cases no swelling of the testicle followed operation. In 7 cases there was slight but temporary swelling. Thrombosis of the veins was not observed in any of the 26 cases. It is seven months since the first two operations. Both are perfect results. The others are recent operations.

When the bundle of veins are unusually large and complete excision is contra-indicated for reasons already given, I have suggested that a portion should be ligated and excised and the remainder transplanted. This has been done in a recent case by Doctor Cushing.

*In children* the veins should not be excised; the probability of

atrophy is greater than in adults. As we have had no recurrence, whether veins have been excised or not, it does not seem to make much difference what is done with the very small cord.

*In the female* also the round ligament and its vessels is such a small affair that it makes little difference what is done with it.

*References to the transplantation of the rectus muscle by Wöfler.*—Wöfler published his method of transplantation of the rectus in 1892 in the *Beiträge z. Chirurgie, Festschrift f. Th. Billroth.* I did not see this publication until my colleague, Dr. Clark, returned from Germany, in June, 1898. My preliminary report had then just been published. For this reason no mention was made of Wöfler's work. In the *Archiv für klinische Chirurgie*, June, 1898, Dr. Slajmer publishes 150 operations after the Wöfler method. A careful reading of these two articles has convinced me that this method of transplantation of the rectus differs from mine. In the first place no special reasons are given for transplanting the rectus muscle, while in my publication the reason given for the transplantation of the rectus is to strengthen the lower portion of the inguinal canal by the introduction of muscle which is weakened by the obliteration of the conjoined tendon. The description of the Wöfler method and the illustration on page 912 of the second article show that the rectus muscle is not transplanted in the best way to strengthen the lower portion of the wound, because the sheath of the rectus is not divided down to the symphysis pubis; but the division of the sheath ends at least 2 to 3 cm. above the pubic bone. For this reason the transplanted rectus muscle is approximated chiefly over the upper two-thirds of the wound. In addition, Wöfler divides the sheath of the rectus on the anterior surface above the linea semilunaris. In my method the sheath of the rectus is divided posteriorly and the belly of the muscle is brought out behind the internal oblique. I believe that by this method the muscle can better be transplanted so as to occupy the lower two-thirds of the wound. Slajmer reports 6 recurrences, about 6 per cent. In three of these cases the wound supplicated.<sup>1</sup>

<sup>1</sup> May 1, 1899. We have not yet observed a recurrence in 30 cases.

SEC. X.—THE SIZE AND VARIETY OF INGUINAL HERNIÆ AND THEIR  
RELATION TO THE OBLITERATION OF THE CONJOINED TENDON.

(1). All herniæ.

		Class a. Conjoined tendon wide and firm.	Class b. Conjoined tendon obliterated.	
Very large	27	17	10	37.0%
Large	88	81	7	7.8
Medium	82	76	6	7.3
Small	169	165	4	2.3
	—	—	—	—
	366	339	27	7.0

This table demonstrates that the conjoined tendon is obliterated in 7 per cent of all cases and in 37 per cent of the very large herniæ.

(2). Direct herniæ.

		Class a.	Class b.	
Very large	4 (14.0%)	1	3	75%
Large	2 ( 2.2 )	1	1	50
Medium	4 ( 4.8 )	1	3	75
Small	8 ( 4.7 )	6	2	25
	—	—	—	—
	18 ( 4.8%)	9	9	50

The conjoined tendon is therefore obliterated in 50 per cent of the cases of direct herniæ. Of the condition of this tendon in the 9 cases in Class B the writer is positive. Of two of the 9 cases in Class A there is no note and the cases have been lost track of; both were small herniæ, one complete and one incomplete. Of the seven remaining cases, I have careful notes. In one case (Group IV, No. 20) the small, incomplete hernia protrudes through a split in the tendon. In Case No. 166, Group I, the tendon was narrow but firm. In Case No. 15, Group IV, it was relaxed. The hernia was very large. In the four remaining cases this tendon was wide and firm.

(3). Indirect herniæ.

		Class a.	Class b.	
Very large	23	16	7	30.4%
Large	86	80	6	6.9
Medium	78	75	3	3.8
Small	161	159	2	1.2
	—	—	—	—
	348	330	18	5.0

The conjoined tendon has been found to be obliterated in only 5 per cent of the indirect herniæ, and in this variety chiefly in very large herniæ (30 per cent of cases). This condition of the conjoined tendon has been found in one case of inguinal hernia in the female in 37 cases (2.7 per cent). It was not found in 68 cases of inguinal hernia in children. Among these 27 cases of herniæ in which the conjoined tendon was obliterated, a hernia has been present on both sides in 9 cases. In 8 of these cases the obliteration of the tendon was present on both sides; in five the operation was performed on one side only; in three cases on both sides. Of these 8 cases, 4 (50 per cent) were of the direct variety.

Table of varieties of inguinal herniæ:

Group I to VIII, 375. 9 cases are excluded because they appear twice.

	Adults.		
	Male.	Female.	Children.
Acquired, indirect	242	29	42
Acquired, direct	17	1	0
Congenital	24	0	21
Infantile	3	0	0

Direct herniæ have never been observed in children. The earliest age at which we have observed a direct hernia to appear was 20 years. Almost 50 per cent of the cases in which the sac was of the congenital variety have been found in children, and in a majority of the remaining cases, although the patient was operated on in adult life, the hernia had appeared before 15 years of age. The writer has not recorded any congenital herniæ in the female, although in at least 6 cases (two children, four adults) the sacs appeared to be of the congenital variety (see XV).

SEC. XI.—OPERATIONS FOR RECURRENT INGUINAL HERNIA, AFTER OPERATION NOT PERFORMED IN PROF. HALSTED'S CLINIC OR BY HIMSELF OR ASSISTANTS.

Nine cases of inguinal hernia in adults have been operated on for herniæ which have recurred after operations performed by other surgeons. In 2 cases (Group I, No. 127, and Group II, No. 3) the recurrence had been associated with suppuration of the wound. In one case the recurrence had taken place in 2 months and in the

second in 6 months. In both cases the conjoined tendon was wide and firm and the recurrence had taken place to the outer side of the tendon and along the cord which had not been transplanted. In Case No. 127 the hernia was of medium size and descended along the cord into the scrotum. In Case No. 3, Group II, the hernia was small and did not descend into the scrotum. Both cases were reducible. The wounds after the second operation in both cases healed per primam throughout. In one the cord was transplanted and in the second it was not transplanted. One case died 3 months after operation from tuberculosis of the lungs with no recurrence of the hernia; at the last examination of the second case (Jan., '93), one year after operation, the wound was solid.

In 3 cases the recurrence had taken place in the lower angle of the wound and was associated with the obliteration of the conjoined tendon (Group I, Case No. 188, and Group I, Case No. 141, and Group III, Case No. 13). The latter case was one of double hernia. In Case No. 188 the patient had been operated upon twice; the wound after the first operation suppurated and recurrence had taken place in the lower angle of the wound at the end of 4 months; after the second operation the wound had healed throughout p. p., but recurrence took place on the lower angle of the wound at the end of 5 months. The hernia was large, reducible, and descended into the scrotum. During our operation (in July, 1897) it was found that the conjoined tendon was completely obliterated; the ordinary suture was employed. The wound healed per primam; patient has not been heard from since operation.

In the case of double hernia, recurrence had taken place on both sides in the lower angle of the wound 3 weeks after operation, the wound having healed per primam. On both sides the recurrent hernia was large and reducible, but it did not descend into the scrotum. At our operation it was found that the conjoined tendon was completely obliterated. The ordinary suture was employed; both wounds healed per primam. This patient has not been heard from since operation (1 year and 7 months ago).

In 4 cases the wounds had healed per primam at the first operation, and there was no evidence of obliteration of the conjoined tendon. In 2 cases, however, the first operation had been performed on account of strangulation, and consisted simply in relieving the constriction, reducing the hernia without any attempt at

radical operation. In Group I, Case No. 92, the hernia had recurred as soon as the patient got out of bed. In Group IV, Case 5, the hernia had recurred 3 months after operation.

In 2 cases the first operation consisted of excision of the sac and suture of the wound without transplantation of the cord. In 1 case (Group I, No. 107) the recurrence had taken place 3 years after operation and was associated with very heavy lifting; the recurrent hernia was situated to the outer side of the conjoined tendon, but did not descend into the scrotum. In the second case (Group III, No. 8) the recurrence had taken place 9 weeks after operation, following a severe injury to the groin. The recurrent hernia was of large size, situated to the outer side of the conjoined tendon and descended into the scrotum along the cord. It was irreducible on account of a mass of adherent omentum. The wounds after our operation suppurred in 2 of these 4 cases; both operations were very difficult on account of scar tissue. In 1 case (Group I, No. 92) the infection was acute and the entire skin incision was opened within 24 hours. This patient has been lost track of. In the second case (Group I, No. 107) only the lower portion of the wound broke down. The ultimate result in this case, in August, '97, 2 years 8 months after operation, is perfect. The wounds in the other two cases healed *per primam* throughout. Both results were perfect in August, 1897 (2 years 8 months and 3 years 9 months after operation).

Our observations on the causes of recurrence in this group of 9 cases show that they are identical with those in our own recurrent cases, viz. the suppuration of the wound and the obliteration of the conjoined tendon. In the 2 cases in which the wound did not suppurate and in which the conjoined tendon was not obliterated, the recurrences followed severe injury and heavy lifting; in the one case nine weeks, and in the other three years after the operation. Recurrences in the other cases all took place within a few weeks or few months after operation and were not associated with any strains or injury.

SEC. XII.—THE SUPPURATION OF THE WOUND AFTER OPERATION  
FOR INGUINAL HERNIA.<sup>1</sup>

Among the causes predisposing to infection after operations for hernia may be mentioned the size of the hernia, difficulty in the operation, the injection treatment previous to operation, and operations for recurrent hernia. We shall consider in this connection the effect of the different suture materials and the wearing of rubber gloves by the operator and his assistants.

The total number of operations in Groups I to VIII (Group VI, McBurney's operation excluded), inclusive, have been 368.<sup>2</sup> Two cases have been excluded. In Group I, Case 113, the patient died on the 7th day; the wound had been opened for inspection and showed no evidence of infection. In Group V, Case 6, the wound was not sutured, but packed with gauze on account of an injury to the bladder. There remain, then, for study of the healing of the wounds, 366 cases, of which 28 were strangulated.

Healing per primam has been recorded when not only the deep wound, but the entire skin incision has healed without the discharge of any purulent material or formation of any visible granulation tissue between the approximated skin edges, and when also no secondary stitch abscesses have occurred after the patients have left the hospital.

Such perfect healing took place in 320 cases (87.44 per cent). In 46 cases (12.56 per cent) some portion of the wound suppurated, or secondary stitch abscesses developed after the patient left the hospital. The 46 cases of suppuration may be classified as follows:

(A). Less extensive suppuration, 16 cases (4%+).

(1). Partial and superficial suppuration of the skin incision, 12 cases; silk 8, silver wire 4. Among these there have been 4 cases of secondary stitch abscesses, 2 silk and 2 silver wire.

<sup>1</sup> January, 1899. The following study of the suppuration of the wound after operation for inguinal hernia is chiefly of historical interest, to the operator as well as all assistants, because since the substitution of silver wire for silk and the use of rubber gloves, the suppuration of the wound has been almost eliminated. Between February, 1897, and January, 1899, 1 year and 11 months, there have been 181 operations for inguinal herniae with only one case of suppuration.

<sup>2</sup> 78 recent cases closed with silver wire, 74 healing per primam, are not included in this section.

(2). Secondary stitch abscesses (wound healing per primam), 4 cases; all silk.

(B). More extensive suppuration, 30 cases (8%+); silk 22, silver wire 8.

(1). Acute (early) infection, 11 cases (3%+); silk 10, silver wire 1.

(a). Early complete opening of the incision, 5 cases.

(b). Later opening of the incision: complete, 4 cases; partial, 2 cases.

(2). Late infection, 19 cases (5%+).

(a). Wounds completely opened, 5 cases; all silk.

(b). Wounds partly opened, 14 cases; silk 7, silver wire 7.

A. (1). In 12 of the 46 cases the suppuration was confined to from 1 to 3 cm. of the skin incision. The depth of the unhealed wound was never more than the thickness of the skin. In no case did the suppuration prolong convalescence, and every patient left the hospital a few days after getting out of bed at the end of the 3rd week, the wounds being completely healed.

In 8 of these 12 cases the wound was closed with silk. Two cases (Group I, Case 23, and Group V, Case 12) returned to the hospital with single stitch abscesses. The ultimate result of these two cases has been perfect, and there has been no further trouble from the remainder of the buried silk sutures. Of the remaining 6 cases, one has been lost sight of since operation (Group I, No. 46) and five are perfect results (Group I, Nos. 27, 31, 35 and 56; and Group V, No. 4).

In 4 of these 12 cases the wound was closed with silver wire. Two patients developed secondary abscesses after their discharge from the hospital. In Case 6, Group II, one month after operation, one silver wire was discharged from the lower angle of the wound. It gave the patient absolutely no discomfort; there has been no further trouble, and the wound was solid at the last examination, January, 1899, after 3 years and 10 months. In Case 22, Group V, patient wrote in August, 1897, 1 year 2 months after operation, that one month after leaving the hospital an abscess formed in the upper angle of the wound and discharged, since which time there has been a small sinus. The hernial wound is solid.

*These two cases represent the only instances out of 252 cases closed with silver wire which have had secondary abscesses.*

(2). Within 1 week to 4 months after their discharge from the hospital four patients, whose wounds closed with silk had healed per primam, returned with stitch abscesses. In 3 of these cases (Group I, Nos. 1, 2 and 8) there was a single abscess, which healed rapidly. In the other case (Group I, Case 71) there were 3 stitch abscesses and sinuses during a period of 8 months after operation. The ultimate results in Cases 1 and 71 have been perfect. In Cases 2 and 8 there is a slight bulging impulse in the scar, corresponding to the site of the stitch abscess, which has not increased in size over a period of 8 years. There have been no cases of stitch abscess occurring after the eighth month.

*B.* (1). Acute infection, 11 cases (3%); silk 10, silver wire 1.

In these 11 cases the temperature rose rapidly within 24 hours after the operation to 104° or 105° F., and there was every evidence of an acute infection.

(a). In five of these eleven cases, all adults, the entire skin incision was opened within 24 hours and left open.

Three of these cases (Group I, Nos. 92, 94 and 95) were operated on the same day (27-6-'94) by the same operator and assistants. The wounds were closed with silk. Neither operator nor assistants wore gloves. Irrigation was not used. Case 92 was a medium-sized hernia, but the operation was difficult, owing to the presence of scar tissue following the injection treatment and a very adherent omentum. Cases 94 and 95 represent a double hernia, but both herniæ were small and the operation was not difficult.

All three skin incisions were opened within 24 hours because of high temperature. Between the fat and aponeurosis of the external oblique, there was a very little blood-stained serum. Cover-slips made and examined at once showed red blood-cells and numerous leucocytes. Many cocci were present, in the leucocytes and free. Cultures showed many colonies of the *staphylococcus pyogenes aureus* and *albus*.

These three wounds were healed completely in from 3 to 4 weeks. The deep sutures did not discharge. Case 92 has been lost track of. Cases 94 and 95 (one patient) was examined in August, 1897, 3 years and 2 months after operation. The wounds were solid, and there had been no secondary abscesses. Examination March 1, 1898, shows slight recurrence on the right side in the lower angle of the scar.

These three, among 22 cases of the more extensive suppuration in wounds closed with silk, represent the only cases in which some or all of the deep sutures did not discharge or form sinuses, and thus demonstrate the value of the early opening of the skin incision in cases of infection.

The remaining two cases are given in detail.

Group III, Case No. 6. Aged 59. Large, reducible, complete hernia. Sac very adherent; subcutaneous fat very thick. Veins and vas deferens excised. Entire skin incision opened in 24 hours because of a temperature of 105° F. The wound was distended with blood, and there was a haematoma in the scrotum. Cultures from the blood-clot were sterile. The temperature remained high for 5 days. On the 14th day a gravitation abscess formed in the scrotum. Patient was discharged in 5 weeks with the wound completely healed. Frequent examinations since. August, '98, after 4 years and 9 months, there is a small bulging and slight impulse below upper third of the scar. No opening. Practically a perfect result.

In this case the suppuration was entirely due to haemorrhage. It might have been the better plan in this case, after washing out the blood, to have closed the wound. This has been done in three cases with perfect results (Group I, Cases 7 and 204, and Group III, No. 18).

Group III, Case 15. Aged 46. Very large, right inguinal hernia. Reducible, direct, complete, acquired. Of 12 years' duration. Patient very stout, weighs 240 lbs. Subcutaneous fat very thick. Sac very large and very adherent. During the dissection the testicle was drawn out of the scrotum, and after the excision and closure of the sac the cord was ligated and excised, and the testicle was returned into the scrotum. Wound closed with silver wire. The operation was very difficult and prolonged. In the wound there were a great many shreds of tissue, and there was some oozing. The temperature after the operation rose rapidly to 105°, and the skin and subcutaneous wound was opened within 36 hours. The wound was distended with blood-stained serum and the scrotum with blood. Cover-slips showed red blood-cells and numerous leucocytes filled with cocci. Cultures gave numerous colonies of the white and yellow staphylococcus. The patient was placed in a continuous bath. The testicle and an area of the scrotum sloughed

on the 9th day. Both wounds healed rapidly by granulation. None of the silver wires discharged. Patient left the hospital in 6½ weeks with two sinuses. One month later one silver wire was discharged. September, 1897, examination after 5 months, wound solid, two sinuses still present.<sup>1</sup>

(b). In six of the eleven cases of acute infection the opening of the wound was delayed until between the 4th and 8th day. In four the entire wound was opened (Group I, Cases 21, 22; Group III, Case No. 1, and Group IV, Case 14). In two cases (Nos. 21 and 22) the wounds were distended with blood. The operation in Case 21 was very difficult, owing to adhesions. The haemorrhage in Case 22 may have come from the excision of the sac of a hydrocele. Cases 1 and 14 were very large and difficult herniæ in boys aged 4 years, in which the subcutaneous fat was thick.

In two cases (Group I, Cases Nos. 32 and 34) only part of the wound was opened. In Case 32 the operation was not difficult, nor was the hernia large. In Case 34, boy aged 4 years, the hernia was strangulated and the skin was prepared hurriedly on the table.

All of these six cases were closed with silk. Complete healing took place in from 8 to 12 weeks. Some or all of the deep sutures discharged. In three cases (Nos. 21, 22 and 32) stitch sinuses persisted a few weeks or months, and in one case (No. 34) the patient returned after two months with a stitch abscess. Five of these six cases were operated on during 1891-92. Case No. 22, Group I, and No. 1, Group III, were operated upon on the same day.<sup>2</sup>

The ultimate results in these 6 cases were as follows: Partial recurrence, 2 cases; weakness in the scar, 1 case; lost track of, 2 cases; perfect result, 1 case. Last examination March, 1896.

The comparison of these six cases in which the wounds were not opened until the 4th or 8th day with the five cases in which the skin incision was opened within 24 hours, demonstrates that in cases of acute infection or with distention of the wound with blood it is better practice to open the entire skin incision at once. This

<sup>1</sup> March, 1899. Examination. Wound healed. Slight recurrence in the upper angle of the wound.

<sup>2</sup> During this year, 1891-92, there were 26 operations for hernia with 9 suppurations (29 per cent), 5 acute infections, 3 late infections, and 1 secondary stitch abscess; all the wounds were closed with silk; gloves were not worn; irrigation was not used. In the majority of these cases the operations were difficult.

prompt procedure promises, in the majority of instances, a more rapid healing, and in some cases limits the suppuration to the skin and subcutaneous tissues, and prevents the discharge of the deep sutures, thus holding out a prospect of a more certain cure of the hernia.

(2). Late infection, 19 cases (5%+).

(a). Wounds completely opened. In five cases closed with silk the entire wound was opened, and all, or nearly all, of the sutures were discharged. All were difficult operations; herniæ large.

In one case (Group I, Case 3) the infection was caused by extravasation of urine from an injury to the bladder by one of the deep sutures; complete healing in 5 weeks; all the deep sutures discharged. Perfect result. Last examination August, 1898, after 8 years 9 months. A recurrence might have been expected in this case.

In one case the wound was distended with blood (Group II, No. 4). Complete recurrence took place (see history).

In 3 cases necrosis of fat was the chief cause of the suppuration (Group I, Cases 9, 39 and 55). Cases 9 and 39 have been lost track of. Case No. 55 is a perfect result (March, 1898, after 4 years and 11 months).

Recurrence or weakness in the scar might have been expected in all of these five cases. In one it did occur. Two, however, are perfect results, 4 to 8 years after the operation. Two have been lost track of.

(b). Wound partly opened, 14 cases; silk 7, silver wire 7. In the 7 cases closed with silk part of the wound was opened between the 12th and 21st day (Cases Group I, Nos. 11, 16, 19, 38 and 73; Group II, No. 1, and Group IV, No. 5).

In one case (Group II, No. 1) the entire lower third of the incision was opened on the 12th day; a sinus persisted for 7 months. Complete recurrence followed. The hernia was large and irreducible, and the operation difficult.

In five cases there were small single stitch abscesses which were opened between the 12th and 21st day. Cases 19 and 38, Group I, have been lost track of since operation. Group I, No. 16, and Group IV, No. 5, are perfect results. In Group IV, No. 5, a sinus persisted for two years. In No. 11, Group I, there is a small bulging in the scar.

In the following case the suppuration was due to a distinct necrosis of fat.

Group I, No. 73. Large, complete, right inguinal hernia, partly reducible. Operation very difficult, owing to very thick subcutaneous fat and a very adherent sac with contents of adherent omentum. The aponeuroses were thin and the muscles were infiltrated with fat. Wound closed with silk. Patient had a very comfortable convalescence, but on the 19th day it was found that the wound was distended with fluid. A small incision was made in the lower angle of the incision, evacuating the fluid, which was chiefly fat debris (necrotic fat). A gravitation abscess formed in the scrotum on the 23rd day. Patient left the hospital in 7 weeks with a stitch sinus in the lower angle of the wound, which healed in 6 months. Examination 2 years and 6 months after operation. Wound solid. September, 1898, letter; result perfect, 4 years after operation.

In the 7 cases closed with silver wire the wound was partly opened between the 8th and the 20th day.

In Cases 125 and 145 of Group I, the suppuration seemed to be due to sloughing of a portion of Poupart's ligament. In Case 107 there was a great deal of scar tissue, the hernia having recurred after an operation in which the wound had suppurred and some tension was required to approximate the tissues. In Cases No. 111, Group I, and No. 17, Group V, there was distinct necrosis of fat. In Case 9, Group II, a small haematoma broke down on the 15th day (see note under history). Group I, No. 224, late suppuration due to sloughing of the edges of the skin incision.

In 5 of these cases the wounds healed completely without the discharge of any of the deep sutures (Cases Group I, Nos. 125, 145 and 224; Group II, No. 9; Group V, No. 17). In two cases a sinus persisted 6 months, closing after the discharge of one suture (Group I, Nos. 106 and 111).

The ultimate results in 6 cases are perfect. In Case 224, Group I, there is a slight recurrence at the position of the transplanted cord.

Note, June 1, 1899. These 10 cases of suppuration (acute infection 1, late infection 7, secondary stitch abscess in wounds in which there was partial suppuration of the skin 2) all occurred in 104 operations in which the wounds were closed with silver wire and in

which gloves were *not* worn by the operator as well as the assistants. Since the wearing of gloves by the operator, as well as by all the assistants, in February, 1897, 2 years and 4 months ago, there have been 226 operations for inguinal hernia with 4 suppurations (1.6 per cent). One case (Group I, Case No. 217) returned 6 months after operation with a stitch abscess beneath the skin due to a silk ligature. No silver wires were removed. Three cases were late infections (Group I (A), Case No. 16), a stitch abscess from which one silver suture was removed.

(Group II, Case No. 30) and (Group IV, Case No. 29) are at present in the surgical wards. Both wounds were opened on the 10th day. In one the suppuration seemed to be due to necrosis of the subcutaneous fat; in the other to sloughing of a small piece of the internal oblique muscle. Both herniae were very large. The wounds are healing rapidly and the probabilities are that none of the silver sutures will have to be removed.

In 316 operations closed with silver wire in which the wounds healed per primam, only one case has returned for the removal of a wire which gave discomfort. (Silver wire was first used June 2, 1894, 5 years ago.)

*Excluding from these 46 cases of suppuration the 8 cases in which the suppuration was confined to a small portion of the skin incision only and in which no secondary stitch abscess has been found, there remain 38 cases (10%) of more extensive suppuration in 366 operations which may be summarized as follows:*

- (1). Acute infection, 11 cases.
  - (a). Associated with distention of the wound with blood, 4 cases.
  - (b). Not associated with any distention of the wound with blood, 7 cases.

These seven cases were without doubt definite hand infections. The cultures showed the staphylococcus aureus and albus. Three operations were performed on this same day by the same operator and assistants, June 27, 1894. Two others on the same day, June 26, 1891.

- (2). Late infection, 27 cases.
  - (a). Associated with haemorrhage, 2 cases.
  - (b). Associated with fat necrosis, 6 cases.
  - (c). Associated with sloughing of tissue, 4 cases.
  - (d). Associated with extravasation of urine, 1 case.

- (e). Early single stitch abscess, 6 cases.
- (f). Late single stitch abscess, 8 cases.

*Table III. The relation between the size of the hernia and the suppuration of the wound. Only the 38 cases of more extensive suppuration are considered.*

The introduction of silver wire and the use of rubber gloves in these cases have reduced the number of cases in each group. The table demonstrates that suppuration is more likely to take place in the larger herniæ.

Size.	Cases.	Suppuration.	Per cent.
Very large	27	8	29
	silk	10	50
	silver wire	17	17
Large	88	13	14
	silk	24	37
	silver wire	64	6
Medium	82	5	6
	silk	19	15
	silver wire	63	3
Small	169	12	7
	silk	63	16
	silver wire	106	2
Total	366	38	10

*The relation between the difficulty of the operation due to adhesions inside and outside of the sac or other complications, and the healing of the wound.*

(1). Adherent omentum, excised, 7 cases, 5 suppurations (71 per cent).

In all of these cases the hernia was large and the operation was prolonged on account of dissection of the adherent omentum and adherent sac. In these 7 cases the sac was opened at once and the omentum dissected free, ligated and excised, after which the sac was dissected free from below upwards and excised. The high percentage of suppurations should be compared with No. 2, in which as large and difficult herniæ were operated on after the method described in this article. The peritoneum was opened above the neck of the sac and the omentum ligated through this

opening and then removed with the sac in one piece from above downwards. Each wound healed per primam.

(2). Adherent omentum, excised, operation very difficult (writer's method), 7 cases, no suppuration.

(3). Large hernia, adherent intestines, 3 cases, 1 suppuration (33%). In 2 cases the operation was prolonged, owing to the difficulty of the dissection; one case suppurated. In one case the adhesions were very few and the operation was not difficult.

(4). Caecum and appendix, 8 cases, 2 suppurations (25 per cent).

The herniæ in these 8 cases were large and the operation difficult. In 1 case the suppuration was due to distention of the wound with blood. The hernia was strangulated and followed immediately upon a severe injury. In the second case the wound healed throughout per primam, but the patient returned one month later with a stitch abscess (silk).

(5). Recurrent inguinal hernia complicated with scar tissue, 9 cases, 2 suppurations (22.22 per cent).

(6). Hernia which had been treated prior to the operation by injections, complicated by scar tissue, 7 cases, 1 suppuration (14.28 per cent).

(7). Strangulated hernia, 30 cases, 4 suppurations (13 per cent).

(8). Adherent omentum, returned, 14 cases, 1 suppuration (7 per cent).

(9). Adherent omentum, excised, operation not difficult, 15 cases, no suppurations.

(10). Omentum not adherent, excised, 9 cases, no suppurations.

(11). Omentum not adherent, returned, 20 cases, no suppurations.

The relation between the age of the patient and the suppuration of the wound:

	Cases.	Suppurations.	Per cent.
Adult males	270	30	11
" females	34	3	8.8
Children, 1 to 15 years	62	5	8

TABLE IV.

## THE DISTRIBUTION OF THE 42 CASES OF SUPPURATION ACCORDING TO YEARS.

Years.	No. of Cases.	Suture.	Suppurations.	Per cent.
1889-90	11	Silk	4	{ Secondary stitch abscess, 2 cases; Late infection, 2 cases. } 36.36
1890-91	19	Silk	5	{ Secondary stitch abscess, 1 case; Late infection, 2 cases. } 26.3
1891-92	26	Silk	9	{ Secondary stitch abscess, 1 case; Late infection, 3 cases; Acute " 5 cases. } 34.6
1892-93	17	Silk	0	0
1893-94	34	Silk	5	{ Secondary stitch abscess, 2 cases; Late infection, 2 cases; Acute " 1 case. } 14.7
	15	Silver Wire	0	0
1894-95	9	Silk	5	{ Acute infection, 4 cases; Late infection, 1 case. } 55.55
	37	Silver Wire	4	{ Secondary stitch abscess, 1 case; Late infection, 3 cases. } 10.8
1895-96	26	Silver Wire	2	{ Secondary stitch abscess, 1 case; Late infection, 3 cases. } 7.6
1896-97	63	Silver Wire	3	{ Late infection, 2 cases; Acute infection, 1 case. } 4.7
1897-98	102	Silver Wire	1	Late infection, 1 case. 1
1898, June to June, 1899.	87	Silver Wire	4	{ Late infection, 3 cases; Secondary stitch abscess, 1 case. } 4.6

COMPARISONS BETWEEN THE HEALING OF WOUNDS CLOSED WITH SILK  
AND THOSE CLOSED WITH SILVER WIRE. COMPLETE TO  
JUNE, 1899.

Excluded from these considerations are the six cases closed with silk and two cases closed with silver wire in which there was only a partial and superficial suppuration of the skin incision and in which no secondary stitch abscess formed. This subtraction leaves 42 cases of more extensive suppuration (9.4 per cent): 116 cases closed with silk, 28 suppurations (24.13 per cent); 330 cases closed with silver wire, 14 suppurations (4.2 per cent).

Silver wire was first used June 2, 1894. With regard to the respective merits of silk and of silver wire as suture materials, our experience has been as follows:

IN 82 CASES CLOSED WITH SILK IN WHICH THE WOUNDS HEALED THROUGHOUT PER PRIMAM, 4 CASES RETURNED WITH SECONDARY STITCH ABSCESSSES. IN 317 CASES CLOSED WITH SILVER IN WHICH THE WOUND HEALED PER PRIMAM, ONE CASE ONLY HAS RETURNED TO THE HOSPITAL WITH A SECONDARY STITCH ABSCESS. In the majority of cases which have been examined the silver wires are not palpable, and in only one case has a patient complained of pain in the wound; in this case one silver wire has been removed.

Of 22 cases of more extensive suppuration of the wounds closed with silk, in 3 cases only did the wounds heal without the discharge of any of the deep sutures; and in these 3 cases the skin incision was opened within 24 hours on account of acute infection. The ultimate result of two of these cases is known two years after operation, and there have been no secondary stitch abscesses.

Of 13 cases of more extensive suppuration in wounds closed with silver wire, in 9 cases the wounds were completely healed in from 2 to 5 weeks without the discharge of a single silver suture. *In 4 cases only there were stitch sinuses.*

In 22 cases of more extensive suppuration in wounds closed with silk, nine of the wounds were completely opened. In 13 cases the wound was only partly opened. In the 13 silver-wire cases which supplicated, the wound was completely opened in 1 case and partly opened in 12 cases.

Silver wire has therefore distinct advantages over silk. Not only have the wounds healed per primam in a greater number of cases, but in those cases in which the wound has supplicated the number of stitch abscesses and sinuses is much less than in the cases closed with silk. We have observed this property of silver, to allow of healing under granulation tissue (if we may use this expression) after operations for compound fracture, in which, on account of the injury to the soft parts, it has been impossible to completely cover the bone, which had been approximated with a silver plate and buried screws or with wire. In these cases, with few exceptions, the plate and buried screws or wire have remained firmly fixed, holding the fracture in good position, and have been completely covered with epithelium. The plate and screws have remained, with few exceptions, in place without giving any trouble, the longest time of observation being 3 years.

## THE WEARING OF RUBBER GLOVES BY THE OPERATOR AND ASSISTANTS.

Coincident with the much more perfect healing of the wounds closed with silver wire have been a few changes in the technique, the most important of which seems to have been the wearing of rubber gloves by the operator himself in the hernia cases. These gloves have been worn by the operator with very few exceptions, and by all the assistants without an exception, from February, 1897, to the present time, June, 1899. During this time there have been 226 operations for inguinal hernia with only four suppurations. 38 of the 42 cases of suppuration therefore occurred before the wearing of rubber gloves by the operator in the hernia operations (silk 28, silver wire 10). The 11 cases of acute infection all occurred before this use of rubber gloves (silk 10, silver wire 1).

104 cases closed with silver wire, 10 suppurations,	9.6%
Gloves not worn by operator.	
226 cases closed with silver wire, 4 "	1.7%
Gloves worn by operator as well as by assistants.	

The writer was the first as operator to wear gloves as a routine practice in practically all clean operations. He began to wear gloves in December, 1896; before this date he had operated on 20 cases of hernia with 4 suppurations, all late infections; wounds closed with silver wire. Since wearing gloves he has operated on 100 cases of inguinal hernia. In one case (recent) the wound suppurred.

Rubber gloves were introduced by Prof. Halsted soon after the hospital opened in 1889.<sup>1</sup> They were invariably worn by the assistant who handed instruments and by the assistant at the wound, usually the nurse in charge of the operating-room. The operator himself rarely wore gloves except when clean joints were opened.

The importance of wearing gloves, especially by all the assistants, and even by the operator, can easily be appreciated. The assistants come from the ward visit, where they may have handled all sorts of infections, directly to the operating-room. It is impossible in a large surgical clinic to isolate or to have dressed by assistants who do not come to the operating-room all cases of granulating and infected wounds. Many of these assistants operate on infected cases in the out-patient department; some assist at autopsies and

<sup>1</sup> The Johns Hopkins Hospital Reports, vol. ii, page 308.

work in pathology and bacteriology. Their hands and finger-nails must always contain all sorts of bacteria, and now and then perhaps very virulent streptococci and staphylococci. It is perhaps impossible to sterilize such hands. The wearing of rubber gloves, which are sterilized by boiling, absolutely excludes hand infection. The writer was led to wear gloves when he operated because as resident surgeon he assisted Prof. Halsted at all of his operations, and was furthermore compelled to handle all sorts of infected cases, to make rectal examinations, and to operate on badly infected cases. He could not feel justified to operate without this protection.

It is our rule now to operate on and to dress especially virulent infected cases with gloves. Rectal examinations can be made with a rubber tip to the fingers. The technique of cleaning the hands is the same whether gloves are worn or not: (1) Scrubbing with green soap and very hot water; (2) permanganate of potassium; (3) oxalic acid; (4) soaking hands and forearms in 1-1000 bichloride at least 5 minutes. The gloves, which have been boiled, are placed in 1-1000 bichloride before each operation and they are drawn on the hands in the solution.<sup>1</sup>

The wearing of gloves practically excludes the danger of hand infection and leaves only one likely source of infection during operation—the skin of the patient. One can school himself to use gloves in almost any operation, and after a time forgets that he is using them.

Other changes in the technique of the hernia operation are as follows:

(1). The higher skin incision, which has reduced the number of ligatures from 10 or 16 to 4 or 6.

(2). The continuous subcutaneous suture introduced by Prof. Halsted; before this an interrupted subcutaneous suture was used.

(3). The covering of the wound with silver foil. The silver in this foil has germicidal properties; it keeps the skin along the incision absolutely dry. These two factors inhibit the growth and perhaps the virulence of the bacteria in the skin. We have at least 75 sterile cultures taken from scrapings of the skin under foil

<sup>1</sup> Doctor Mitchell has introduced the method of anointing the hands with a sterilized boric ointment before the gloves are pulled on. It has proven to be a great aid. The gloves slip on more easily and are less likely to be torn.

dressings. Before the use of foil protective was employed to cover wounds; moisture always collected under this protective and we never succeeded in getting a sterile culture under it; there were always a few or more colonies of the staphylococcus albus and sometimes the colon or hay bacillus, and now and then the staphylococcus aureus. Inoculations made by dropping into a test-tube the silver wire suture withdrawn from the skin in a few cases were sterile; in the majority of cases there were a few colonies of the staphylococcus albus.

(4). The incasement of the patient from knees to costal margin in a large dressing of gauze held in place with splints and plaster of Paris. This dressing keeps the patient quiet and prevents flexion of the thigh and makes gentle pressure on the wound. The dressing is cut down on the side opposite the wound in 10 to 14 days, turned up and the wire removed; the dressing is finally removed in 18 to 21 days. These patients give practically no trouble, are very comfortable and require but one dressing in three weeks. Formerly the wound was covered with a small dressing of gauze and sealed with collodion.

(5). The preparation of the skin of the patient: (a) shaving of abdomen, pubes and thighs; (b) bath; (c) scrubbing with green soap and sometimes a poultice of this soap from 10 to 20 minutes; (d) scrubbing with (1) water; (2) ether; (3) alcohol; (4) sol. potassium permanganate; (5) sol. oxalic acid; (6) sol. bichloride of mercury 1-1000; (e) incasement of the patient in a sterilized dressing. After the patient is under the ether this dressing is removed and the skin is again cleaned with alcohol and the bicloride solution 1-1000. The use of potassium permanganate and oxalic acid constitutes the changes in the technique of the preparation of the skin.

SEC. XIII.—INGUINAL HERNIÆ WHICH WERE TREATED PRIOR TO  
THE OPERATION AND BEFORE ADMISSION TO THE HOSPITAL  
BY THE INJECTION TREATMENT.

Under this heading are included 7 cases (Group I, Nos. 91, 92, 110, 126, 133 and 151, and Group II, Case No. 13). All were adult males. The duration of the herniæ varied from 2 to 24 years. In 2 cases the hernia was large, in 2 of medium size, and in 3 small. All of the cases had been injected over periods varying from 6 months to 1 year. The number of injections had varied from 15

to 30. In not one case was there any evidence of improvement after the treatment. During operation scar tissue was found binding the aponeurosis of the external oblique to the deep abdominal fascia, and also in the inguinal canal about the sac and the cord. In 5 of these 7 cases the amount of new connective tissue was not great and did not complicate the operation. In these 5 cases the last injection in 3 cases had been given 6 months prior to operation; in 1 case, 1 year; and in 1 case, 5 years. In the 5-year case there was very little new connective tissue. In two cases the scar tissue in the inguinal canal about the sac complicated the operation. In these 2 cases the last injections had been made 2 months prior to operations. One of these cases supplicated (Group I, Case 92), the infection being acute. This case has been lost sight of since operation. The ultimate results in the 6 cases in which the wound healed throughout per primam have been perfect, the last examination since operation varying from 7 months to 3 years and 2 months.

#### SEC. XIV.—THE CONTENTS OF THE SAC IN INGUINAL, UMBILICAL AND FEMORAL HERNIA.<sup>1</sup>

##### (1). *Caecum and appendix, 9 cases (inguinal 8, umbilical 1).*

Inguinal hernia in which the sac contained the cæcum and appendix, 8 cases (Group I, Nos. 1, 12, 58, 189, 217 and 258, and Group II, Nos. 1 and 4). Five cases were observed in children æt. 8 years, 3 years, 2 years, 21 months and 13 months. In three cases the sac was of the congenital variety, and in two of the acquired variety. In all the five cases the hernia had been noticed shortly after birth. Four were large herniæ and one very large. Two reducible; three strangulated; all complete. In two cases the appendix was removed (in one because it was adherent). In one (Case No. 217) the following note was made of the sac, which was of the congenital variety: The peritoneum of the sac beginning near the neck was continuous with the peritoneum of the cæcum, so that part of the sac was formed by the meso-cæcum.

Three cases were observed in adults æt. 30, 35 and 48 years. In each case the sac was of the acquired variety and indirect. Two were very large herniæ and one large. Two were reducible; one had been present since early life (47 years), and one for 10 years, since

<sup>1</sup> 20 recent cases included in other sections have not been introduced into this section.

20 years of age. One was strangulated and of immediate formation following directly after a severe injury of the groin; all three descended into the scrotum. In the last case the appendix, which showed evidences of contusion, was excised. In Case No. 258 the appendix occupied a diverticulum in the sac. The relation of the sac to the cæcum in two cases was noted to be the same as in Case No. 217.

The sac has therefore contained the cæcum and appendix in inguinal hernia in 2 per cent of cases. In 6 cases the hernia appeared shortly after birth, in one at 20 years of age, and in one after a trauma; 3 were congenital and 6 acquired.

Umbilical hernia, 1 case. Female, æt. 52 years. Hernia present for 31 years, since 16 years of age. It was very large and had been strangulated 4 days before admission. The sac contained in addition to the cæcum and appendix the transverse colon, some small intestines and a mass of omentum. All of the 9 cases recovered from the operation.

(2). *Appendix alone.*

1 case, inguinal hernia (Group I, Case No. 148), boy, age 7 years. The hernia was reducible and congenital; the appendix, which was long (10 cm.) but not adherent, was excised.

In 6 cases, therefore, the appendix has been removed.

(3). *Sigmoid colon, 6 cases; all left inguinal herniae.*

Group I, Nos. 159, 180, 222 and 227; Group II, Nos. 7 and 20. These form a very interesting group of cases. All adult males, aged 29 to 51. Herniæ of 1½ to 9 years' duration. Earliest age to appear, 25 years. In all the sac was of the acquired variety. 3 were direct and 3 indirect; 4 complete; 2 incomplete (one direct). Very large, 1; large, 2; medium, 2; small, 1; all reducible. In 1 case, Group II, No. 7, the sac was not opened, but one could plainly see the longitudinal band of the colon and the mesentery forming part of the sac. In 5 cases the sac was opened. In 3 of these cases it was distinctly to be made out that the peritoneum of the sac was continuous with the peritoneum of the colon. In 2 there was no such relation. In 1 case the colon was very adherent. In 1 case, just as the sac was opened the patient vomited and the colon was cut. The wound was sutured. In 2 cases omentum was also present in the sac. All 6 cases recovered.

It is important when operating on left inguinal herniæ to remember this condition, and in opening the sac to avoid injury of

the colon and its mesentery. In these cases one cannot excise all the sac without encroaching on the mesentery, and must be content with a very little excision or a simple closure. If the method described on page 245 is followed—opening the peritoneum above the neck of the sac after the division of the aponeurosis of the external oblique muscle and internal oblique muscle—the operator can at once recognize this condition and all danger is avoided.

(4). *Small intestine. Inguinal hernia.*

(a). Irreducible hernia; radical operation impossible because of the extensive adhesion.

In 4 cases the hernia was irreducible and a radical operation impossible on account of the extensive adhesions between the sac and the intestines (Group XII, Nos. 1, 2, 3 and 4). In all these cases the patients were adults, aged 50, 52, 67 and 74 years, and the hernia had been present 2, 6, 8 and 20 years. The herniæ were all of good size and were situated on the right side, and had been irreducible from 3 months to 2 years. In 3 cases the patients were admitted with symptoms of strangulation. In Case No. 2 the point of obstruction could not be found and an artificial anus was made. Death followed operation; an autopsy could not be obtained. In Case No. 3 the symptoms of strangulation were relieved by the division of the neck of the sac; this patient recovered. At the operation in this case an intestine was accidentally opened; the opening was sutured, but afterwards the wound broke down and patient had a faecal fistula for 3 weeks. In Case No. 4 the symptoms of strangulation were caused by an additional loop of non-adherent intestine which had entered the lumen of the sac through the neck, a distance of about 3 cm. At the operation it was found to be gangrenous; it was drawn out of the wound and held in place by gauze; patient died a few hours after operation from general peritonitis, which may have been present at the time of operation. In Case No. 1 there were no symptoms of strangulation; an attempt was made at radical operation, but the adhesions between the intestine and sac were too extensive. In all of these cases the gut which occupied the sac seemed to be derived from some part of the small intestines.

(b). Radical operation. Intestines very adherent; hernia not strangulated. 3 cases; all adults, males. In Case No. 6, Group I, the adhesions were not very extensive. In Case No. 1, Group II, the adhesions were extensive, the sac containing a mass of very

adherent omentum. The wound suppurated and the hernia returned. The operation in Case No. 5, Group IV, was the most difficult among all the 364 radical operations for inguinal herniæ. The hernia was very large and irreducible. Castration was performed; the wound healed per primam with the exception of a single stitch abscess (silk). The ultimate result has been a perfect one, August, 1898, 4 years and 9 months after operation.

(c). Small intestine in strangulated hernia. Intestine was present in the sac 33 times in 38 cases. In 2 cases the sac was found to be empty when it was opened, and in 3 cases the sac contained omentum alone.

The condition of the intestine was as follows:

(1) Intestine alone reduced, no bad result followed	19 cases
(2) Intestine reduced, also omentum. In 4 cases the omentum was excised	6
(3) Intestine reduced and omentum excised, followed by general peritonitis	1
(4) Intestine gangrenous	2
(5) General peritonitis, reduction "en bloc"	1
(6) Chronic obstruction following reduction; evidently gangrene with faecal fistula	1
(7) Irreducible hernia, symptoms of strangulation (see a)	3

#### *Umbilical hernia.*

In 4 cases among 13 of hernia at the umbilicus the sac contained intestine. 1 case was strangulated and there was present a general peritonitis; death followed 36 hours after operation. The hernia was very large and had been present 4 years. The symptoms of strangulation began 6 days before admission to the hospital. The sac contained almost all the small intestines and a mass of omentum, but no adhesions were present (Group XI, No. 4).

In one case the hernia was large and irreducible—a colored child, age 5 years. The sac was full of very adherent intestine, the seat of a tubercular peritonitis. In separating these adhesions the intestines were torn in two places so extensively that two resections and sutures had to be done; death followed in 36 hours. Autopsy, streptococcus peritonitis (see Group XIII, No. 1).

In one case the sac contained both adherent intestine and omentum. The omentum was excised and the intestine dissected

free and returned. The hernia was very large and irreducible; the skin was ulcerated and the operation was a very difficult one; the wound healed per primam. The ultimate result is a perfect one (Group IX, No. 7). This case illustrates the fact that frequently in these very difficult cases the surgeon succeeds far beyond his expectations. The hernia in this case made the life of the patient almost unendurable.

In one case (No. 21) the hernia was very large and strangulated; the patient's general condition was very critical. The operation was performed under cocaine with a few whiffs of chloroform while the contents of the sac were reduced. The sac contained the cæcum, appendix, colon and small intestines and a mass of omentum. The omentum was excised and the gut returned. The patient recovered.

One of the three cases of hernia situated in the linea alba between ensiform and umbilicus was strangulated; the sac contained intestines.

There has been one case of strangulated traumatic hernia. The patient was caught between the bumpers of two freight cars; the right rectus and right lateral abdominal muscles were ruptured and most of the small intestines protruded beneath the uninjured skin. Recovery followed operation (Case No. 19, Group IX).

*Intestine in femoral herniae.* In 31 cases of femoral hernia 17 have been strangulated (over 50 per cent). In 5 cases (39 per cent) the intestines were gangrenous (4 cases) or general peritonitis was present (1 case). In 8 cases the intestine was in good condition. In 2 of these there was a piece of omentum in the sac. The sac in 3 of the remaining cases contained omentum, and in one it was found to be empty. The danger of gangrene is greatest in femoral herniae.

#### (5). *Omentum.*

We have recorded the presence of omentum only in those cases it which it was found to be in the sac at the time of operation; without doubt there were other cases, perhaps a good many, in which omentum descended into the sac, but which at the time of operation was reduced.

Inguinal hernia, 377<sup>1</sup> cases. Omental contents in 73 cases (19 per cent).

<sup>1</sup> Only 377 of the 405 cases of inguinal hernia are included in this section.

Omentum not adherent	29 cases
1. Omentum reduced	20
2. Omentum ligated and excised	9
Omentum adherent	43
3. Adhesions cut, omentum reduced	14
4. Omentum ligated and excised	29

Among 218 cases of right inguinal hernia the sac has contained omentum in 44 cases (20 per cent) (the hernia large or very large in 22 cases, of medium size or small in 22 cases).

Among 159 cases of left inguinal hernia the sac has contained omentum in 29 cases (18 per cent); large or very large in 9 cases, medium or small in 20 cases. These observations do not agree with those of Treves in his *System of Surgery*, vol. ii, 1896, in which it is stated that the omentum is much more commonly present in left inguinal hernia, due perhaps to the position of the omentum.

Omentum has been found only slightly more commonly in the cases of large and very large herniæ, 124 cases, omentum 31 cases (25 per cent). In medium and small herniæ, 253 cases, omentum 42 cases (16 per cent).

Adult males	273 cases	Omentum	59 cases	21%
Adult females	37 "	"	8 "	21%
Children	67 "	"	6 "	9%

These observations correspond with those of Treves in his *System of Surgery*, in which it is stated that the omentum is less frequently found in the sac in inguinal hernia in children.

The omentum was found to be adherent in 43 cases (almost 60 per cent). In 14 cases there were but one, two or three adhesions, which were easily cut, allowing the reduction of the omentum. In 29 cases the adhesions between the sac and the omentum were more extensive, and in these cases the omentum was ligated and excised; in about 14 of these 29 cases the adhesions between the sac and the omentum were very extensive, making the dissection a difficult one.

In none of our cases have we found adhesions between the omentum and intestines; in none of these cases were we able to demonstrate that the sac contained any of the appendices epiploicæ. One of these was present in the sac of a case of femoral hernia,

demonstrated at the autopsy (Group No. X, Case No. 9). In a majority of these cases the adhesions between the omentum and sac have been situated in the fundus; in 5 cases the adhesions were present only between the omentum and the neck of the sac.

Among 19 cases of irreducible hernia, omentum alone has been found in 11 cases. In 8 of these cases the omentum was adherent.

Omentum has been present in 9 of 38 cases of strangulated inguinal hernia; in 3 cases the omentum alone and not adherent; in 6 cases the sac contained intestine also and in one case the omentum was adherent. The adhesions, however, were not the cause of the strangulation.

In only one case of hernia have omental adhesions been the cause of strangulation, and in this case, a femoral hernia (Group IX, No. 8), the loop of intestine which was strangulated beneath a single band was gangrenous.

(1). Omentum not adherent, reduced, 20 cases: reducible, 14 cases; irreducible, 3 cases; strangulated, 3 cases. In these 20 cases the omentum gave no difficulty during the operation and the wounds healed throughout per primam. In 3 cases intestine (2 strangulated, 1 irreducible) was also present in the sac, but the omentum was not adherent and did not add difficulty to the operation.

(2). Omentum not adherent, ligated, excised, 9 cases: reducible, 5 cases; strangulated, 3 cases; irreducible, 1 case. In the 3 cases of strangulated hernia, omentum was excised because of its impaired circulation. In 2 cases intestine was also present in the sac; wounds healed per primam throughout. In the 6 cases of non-strangulated hernia the rupture was very large in 1 case, large in 3 cases, medium in 1 case, small in 1 case. In only 2 of these cases in which the omentum was excised could the mass of omentum be reduced without difficulty. In the remaining 4 cases the ligation and excision were indicated by the size of the mass and its induration. In all of these cases the wounds healed per primam.

(3). Adherent omentum, adhesions cut, omentum reduced, 14 cases: reducible, 12 cases; irreducible, 2 cases. In all of these cases the adhesions were but few in number and easily divided; omentum reduced. Large hernia 4 cases, medium-sized 3 cases, small 7 cases. In 4 cases the adhesions were situated only between the omentum and neck of the sac. The wounds healed

per primam in 13 cases; in 1 case part of the wound suppurred (late infection).

(4). Adherent omentum, ligated and excised, 29 cases: reducible, 21 cases; irreducible, 7 cases; strangulated, 1 case. (a). In 15 cases the operations were not at all difficult. 12 cases reducible hernia, 1 irreducible, and 1 strangulated; 6 of large size, 4 of medium size, and 5 small. In all of these 15 cases the operations were not difficult; the wounds healed throughout per primam.

(b). In 7 cases the operations were very difficult, on account of the size of the hernia and the extensive adhesions between the sac and the large mass of omentum. Irreducible, 5; reducible, 2. Of large size 5, of medium size 2. These 7 cases were among the early operations, and the preliminary division of the internal oblique muscle was not done; the sac was first opened and the adherent omentum was dissected free, then ligated and excised; after this the very adherent sac was dissected from below upwards, closed and excised. In 1 of these cases (Group III, Case No. 8) there was a profuse haemorrhage from the ligated stump of the omentum, after its reduction through a rather small opening, which, however, was done with the greatest of care. The haemorrhage was so profuse that the operator considered that it would take less time to perform a median laparotomy than to enlarge the opening into the peritoneal cavity. This was done and the bleeding vessels were found and tied. If at this operation the internal oblique muscle had been divided and peritoneal cavity opened into above the neck of the sac, the much larger opening made by this procedure would have allowed the operator to have found at once the bleeding stump of the omentum and to have withdrawn it with great ease from the abdominal cavity.

In ligating and excising omentum the greatest care should be taken to ligate small masses with one ligature and tie this ligature snugly. It is safer also to have a large opening into the peritoneal cavity through which to reduce the ligated stump of the omentum. Even when all these precautions are taken haemorrhage now and then may be expected. In every case the operator, after he has replaced the ligated omentum, should wait a few minutes before closing the opening into the peritoneal cavity. In 2 cases (Group I, No. 202, and Group IV, No. 13) the writer, after excising a very large mass of omentum requiring some 15 or 20 ligatures, reduced it without

any force into the peritoneal cavity through a large opening made by the division of the internal oblique muscle and opening of the peritoneum above the neck of the sac; after waiting but a few seconds it was noticed that the stump was bleeding; it took, however, but a moment to find and withdraw the bleeding stump through this larger opening.

In these 7 cases, by first dissecting the omentum from the sac and then the sac from surrounding tissue, the operation was prolonged and the tissues were handled more than is usual. In 5 of these cases the wounds suppurred. It was the results in the healing of the wound in these 7 cases, and also the difficulty of reducing the ligated stump or finding again a bleeding stump, that led the writer to adopt his method of procedure in these cases; that is, the division of the internal oblique muscle and the opening of the peritoneal cavity above the neck of the sac; through this opening the omentum is ligated and the stump replaced. The sac with its contents of adherent omentum is then removed in one piece from above downwards. (c). The writer has had an opportunity of following this procedure in 7 cases, in which the omentum was very adherent; 3 large irreducible, 5 large reducible herniæ. In these cases the result was very satisfactory and the wounds healed throughout per primam. He has also followed this method in 3 cases of large omental hernia in which the omentum was not adherent; in 2 of these cases the omentum was excised, in 1 case it was reduced. In 2 cases in which the adhesions were present only between the omentum and neck of the sac these adhesions were divided with less difficulty through the opening above the neck of the sac and omentum reduced.

*Omentum in umbilical hernia.* 8 cases in 13: strangulated, 2; irreducible, 5; reducible, 1. In the one case of strangulated hernia the omentum was not adherent. In the remaining 7 cases it was adherent and was excised.

*Femoral hernia.* Among 31 cases of femoral hernia, omentum was present in 11: reducible, 3 cases; irreducible, 2 cases; strangulated, 6 cases. In 10 of these cases it was excised. In 9 cases it was adherent and in 2 not adherent. In Case No. 20 the omentum was the seat of a lympho-sarcoma (see history). After the partial excision of the omentum and new growth there was so much oozing that the wound was packed.

In 55 cases (38 inguinal, 7 umbilical and 10 femoral) omentum has been excised. In 4 cases some bleeding followed the reduction of the stump (already described). No deaths from haemorrhage.

(6). *Properitoneal fat.* In inguinal and more commonly in femoral hernia there are frequently situated about and often adherent to the sac masses of vascular fat which in many cases it is a better plan to excise. In some cases the bulging of the hernia is chiefly made up of this fat. As a distinct hernia with no sac they are met with in the median line and are often associated with attacks of nausea and vomiting.

*Inguinal hernia.* In 11 among 375 operations for inguinal hernia this properitoneal fat has been present in sufficient amount to be worthy of a special description.

In 3 cases it was not excised. In one of these cases (a child, indirect hernia), in drawing the sac out to close the opening into the peritoneal cavity the bladder was brought distinctly into view, and this mass of fat, which was situated on the lower and medial side, was continuous with that in the space of Retzius (Group I, Case No. 114). In one case, an adult female (Group V, Case No. 31), the conjoined tendon was obliterated and the hernia consisted of a small mass of very vascular fat continuous with the fat in the space of Retzius. There was no distinct sac. In this case it was considered unnecessary to excise, and, moreover, the excision would have been very difficult, owing to the numerous vessels.

In 8 cases the mass of properitoneal fat was excised with the sac. In all of these cases it was adherent to the sac and usually occupied a position between the sac and the posterior wall of the inguinal canal. Cases Group I, Nos. 46, 55, 82, 135 and 139; Group IV, Nos. 21 and 22; Group V, Nos. 11 and 28. The position of the mass of properitoneal fat in Case No. 21, Group IV, was a very remarkable one (see history). In Case No. 11, Group V, the lumen of the sac was obliterated and the fibrous cord was surrounded by properitoneal fat. All of these 11 cases were reducible.

*Femoral hernia, properitoneal fat.* In 10 cases (33 per cent) the sac was surrounded by this tissue, which was very vascular (reducible herniæ, 5; strangulated, 2; irreducible, 2). In femoral hernia this fat complicates the operation more than in inguinal hernia. The complete excision is often tedious, as many vessels require ligation. For this reason the writer, after opening the sac

and reducing its contents, divides the sac across below the neck, closes the opening into the peritoneal cavity and strips the sac from above downwards, peeling it out of this vascular properitoneal tissue.

Umbilical herniae have very little tissue between the sac and the skin. So little tissue is there in some cases of large umbilical hernia that decubitus and ulceration of the skin often take place. This has been present in two of the 12 cases. In one case the ulcerated skin had to be dissected away from the adherent intestine.

Two cases of ventral hernia were situated in the median line midway between the ensiform and umbilicus, and consisted of an encapsulated mass of properitoneal fat. Both were associated with attacks of nausea and vomiting.

(7). *Fluid in the sac.* In two cases fluid has distended the sac and the tumor was irreducible (hydrocele of the sac).

Group I, Case No. 134. Inguinal hernia, boy, age 5 years. This patient was admitted with a supposed hydrocele of the cord. In the right groin, not descending into the scrotum, was a tense tumor, dull on percussion and irreducible. The boy remained in the ward a few days before operation, and on two occasions the tumor disappeared, although when it was present one could not reduce it. Just before operation the swelling disappeared. At the operation a small hernial sac was found, the neck of which was partly plugged by a small piece of omentum. The omentum was not of sufficient size to have produced the tumor, and the opening at the neck was not large enough to have allowed anything but fluid into the sac.

Group X, No. 10. Femoral hernia, age 49 years. The patient for 20 years had noticed a small tumor in the right groin, which only during the last few months had increased in size; on admission it was the size of a large orange (8 x 8 cm.), while before it began to enlarge its size was that of a chestnut (3 x 3 cm.). It was always irreducible. The tumor was tense and smooth. At the operation it consisted of a sac of a femoral hernia distended with a clear yellow serum. The opening into the peritoneal cavity admitted a probe 3 mm. in diameter.

Fluid was present in the sac in 13 of the 38 cases of strangulated inguinal hernia, which also contained intestine: in 8 cases blood-

stained; in 4 cases clear, and in 1 case cloudy, almost "chyle-like." Cultures in all, sterile. In the 5 cases in which omentum alone was present, fluid was absent. In 4 cases of femoral hernia fluid was present; 3 associated with intestine, 1 clear, 2 blood-stained, 1 case associated with omentum only (blood-stained). Cultures, sterile. In all strangulated herniæ in which the gut was gangrenous the sac contained blood-stained fluid. In the cases in which a general peritonitis was present the sac did not contain fluid. In the cases of umbilical and ventral herniæ no fluid was found in the sac.

(8). In 5 cases below the hernial sac and adherent to the cord or round ligament we have found a second sac, or rather a cyst, lined by peritoneum and filled with a clear fluid. Examinations of stained specimens of this fluid showed endothelial cells, many of which contained vacuoles. These cysts (hydroceles of the cord) were probably at one time portions of the hernial sac which had become *closed off* (Group I, Cases Nos. 22, 59, 142, 203, and Group V, No. 26).

(9). *Tube and ovary.* In 3 cases of inguinal hernia among 37 cases these organs have been present in the sac.

Group V, No. 2, age 45 years. Small, right inguinal hernia, reducible, incomplete, indirect, of 5 years' duration. The wearing of a truss was so painful that it was discontinued. There were no adhesions between the sac and its contents.

Group V, No. 26, age 38 years. Small, double inguinal herniæ, reducible, incomplete. The hernia of the left side, which contained the tubes and ovary, had been noticed for ten years. The patient desired operation because of the pain and discomfort produced by a truss, and also the almost constant pain in the groin even when the truss was not worn. On opening the sac the tube was adherent by one narrow band, which was divided and both organs returned. In these 2 cases the presence of the tube and ovary in the sac appears to be accidental; the peritoneum of the sac was not reflected over the ovary, as in the next case.

In Case No. 38, Group V, the sac was opened before the internal oblique muscle was divided; projecting from the posterior wall of the sac was a spindle-shaped tumor extending the full length of sac, corresponding to the position of the round ligament; macroscopically it looked like ovary. To get a better view of its relation the internal oblique muscle and peritoneum were divided above the neck

of the sac; the tumor was then found to extend from the fundus of the sac to the neck, but not into the abdominal cavity. At the neck of the sac it seemed continuous with the round ligament and vessels accompanying it. It seemed to have no connection with the uterus. The peritoneum was divided across the neck of the sac and the operator ligated what seemed to be round ligament and its vessels. The wound in the peritoneum was then closed with silk and the sac with this spindle-shaped tumor removed. Between the lower end of the sac, extending through the external ring into the subcutaneous tissue of the mons veneris, was a definite band of tissue which was excised with the sac and the tumor. The spindle-shaped tumor, which was covered by the peritoneum of the posterior wall of the sac, proved to be an ovary which had descended into the canal of Nuck, carrying with it a pouch of peritoneum.

(10). *Hour-glass constriction of the sac.* In 8 cases of inguinal hernia it has been noted at the operation that there has been a constriction of the sac situated at a position between its neck and the lower end. In 6 cases the hernia was of the acquired, indirect variety, in 1 case congenital, and in 1 case infantile. In 2 cases the hernia was strangulated, and both of these cases gave a history of two other attacks in which the hernia had become irreducible, associated with symptoms of strangulation. The sac in 1 case contained omentum and in the other intestine; both cases recovered. In 1 case the hernia had been irreducible a few days before admission and contained omentum. In 4 cases the sac was empty. All the cases were adults and the hernia varied in duration from 1 to 18 years. In 3 cases the hernia was large, in 2 of medium size, and in 3 small. In one case, a congenital hernia (Group I, No. 156), the constriction was complete. In 1 case (Group II, No. 13) the lumen of the sac at the point of constriction measured about 5 mm. in diameter. Each department of the sac contained a portion of omentum, joined by a narrow cord of fibrous tissue containing vessels which passed through the constricted portion of the sac, but were not adherent to it.

This condition of the sac is described as "the hour-glass sac," and these observations do not agree with those of Treves in his System of Surgery, vol. ii, p. 715, 1896, in which it is stated that the hour-glass sac is found almost exclusively in that form of congenital hernia in which the funicular process is patent.

(11). *The relation between the bladder and the sac.* In Group I, Case No. 3, it was found after operation that the wound was filled with extravasated urine, and it was supposed that during the introduction of one of the deep sutures the bladder had been included, although at the operation the bladder had not been recognized. The hernia was large and of the indirect variety. In Group V, Case No. 6, the hernia was of the direct variety in a female. After the sac had been opened, excised and the opening into the peritoneal cavity closed, a second sac was found situated to the medial and lower side of the first sac. The operator thinking that it was a second hernial sac opened it; it proved to be the bladder. The opening was sutured and the hernial wound packed with gauze; the wound healed in 4 weeks. There was no extravasation of urine. Ultimate result is a perfect one, August, 1897, 6 years after operation. In Group II, Case No. 9, the hernia was of great size and of long duration, of the acquired variety and reducible. At the operation it was found that the sac was adherent to the bladder. The dissection of the sac from the bladder was difficult, but was performed without any injury to the bladder. The wound was closed, leaving a small dead space in the lower angle. On the 15th day a blood-clot which had formed in this dead space broke down. The cavity, however, was healed when the patient was discharged at the end of  $3\frac{1}{2}$  weeks. The ultimate result has been a perfect one, December, 1897, 1 year after operation. In 2 cases, both in children (Group I, Nos. 17 and 114), the bladder was brought into view when the sac was drawn forward. In both of these cases the hernia was of the indirect variety, and the conjoined tendon was wide and firm.

(12). *Hernia associated with undescended testicles.* 11 patients, about 3 per cent. Two double, four on the right side and five on the left.

In one patient (Group IV, Nos. 3 and 4) the small sacs were of the acquired variety. In the other cases these sacs were of the congenital variety.

11 cases were reducible and incomplete; 1 was irreducible, due to omentum; and 1 case was admitted with symptoms of strangulation. In this case the sac was very large and had descended into the scrotum at 15 years of age, 10 years before admission; the sac contained omentum.

In all of these cases the testicle was non-developed. In 2 cases the testicle was replaced into the abdominal cavity (Group VII, Nos. 3 and 4), one left and one right (Cushing). In 2 cases the testicle was transplanted into the scrotum (Bloodgood), Group I, No. 205, right side, and Group II, No. 21, left side. In the remaining cases it was excised.

In Group I, Case No. 205, an adult, the hernia was of small size, and neither the hernia nor the testicle had ever descended into the scrotum; the patient was quite positive of this fact. Both the testicle and hernia would now and then protrude slightly from the external ring, but never further. At operation there was a large pouch of peritoneum communicating with the general peritoneal cavity and covering the testicle, and this pouch of peritoneum had descended into the scrotum, so that in this case the pouch of peritoneum which had accompanied the testicle in its descent had been drawn into its position in the scrotum without being accompanied by the testicle. A similar observation has been made on a recent case.

(13). *Herniae, interstitial variety, 3 cases.*

Group IV, Case 17, was a small interstitial hernia of the third variety as described by Treves in his System of Surgery, vol. ii, 1896. The sac protruded from the external ring, and instead of descending into the scrotum, ascended parallel with Poupart's ligament towards the anterior iliac spine for a distance of about 4 cm. The sac lay between the aponeurosis of the external oblique and the inter-columnar and deep abdominal fascia. The testicle was situated just outside of the external ring, but could be pushed upwards in the pouch of the sac which rested on the aponeurosis of the external oblique. A second pouch extended in the direction of the scrotum, and third pouch extended upwards and outwards between the transversalis fascia and internal oblique muscle, distance of about 2 cm. All of these pouches communicated with the lumen of the sac, which was continuous with the peritoneal cavity, and this portion of the sac contained a piece of omentum which was adherent at one point.

Group VII, No. 4, patient æt. 17 years. The small congenital sac and testicle had descended through the external ring and lay between the aponeurosis of the external oblique and the deep fascia. The lumen of the sac in the inguinal canal was very narrow.

Group II, No. 21, patient *æt.* 33 years. Hernia very large, forming an irreducible tumor occupying the left inguinal region. The sac was large and situated between the aponeurosis of external oblique and deep abdominal fascia, but extended from pubis upwards and outwards to a line between the anterior iliac spine and umbilicus. The sac wall was thin and not adherent; it was easily separated from the surrounding tissue. Sac did not extend into the scrotum. The external ring (which corresponded to the neck of the sac) was about 3 x 2 cm. in diameter; sac contained a large mass of omentum which was not adherent. This omentum was drawn out, ligated and excised. Occupying the dorsal portion of the sac, one saw the gubernaculum of the testicle, but not the testicle itself. After separating and excising a portion of the sac and excising the omentum, the aponeurosis of external oblique was divided, and the stump of omentum reduced; the testicle was then seen in the abdominal cavity; it could be drawn out 1 cm. beyond the external ring, but no further. It was small and undeveloped.

(14). *Sac not opened.* In 20 cases among 347 operations for non-strangulated hernia the sac has not been opened; males 18, females 2. In these 20 cases the sac consisted of a bulging of the peritoneum (bubonocele). In 2 cases there were special reasons for not opening the sac, which have been already described and, Group II, No. 7, because at the operation the longitudinal bands of adherent colon were recognized through the wall of the sac, and in Group V, No. 31, because the pouch of peritoneum was covered by a large mass of vascular peritoneal fat. In all these cases there was present before operation a distinct hernia protruding from the external ring, in every case reducible, but in every case giving sufficient discomfort to bring the patient to the hospital for operation. The ultimate result of 16 cases is known and the result in every case is perfect. Time since operation varying from 6 months to 3 years and 7 months. 4 cases have been lost sight of since operation.

#### SEC. XV.—THE RELATION OF THE SAC TO THE CORD IN ACQUIRED AND CONGENITAL HERNIA.

(1). The relations of the cord to the sac in congenital inguinal hernia in the male.

In these cases of hernia the sac has somewhat the same anatomical relation to the cord that the peritoneum has to the colon; that is, the peritoneum of the congenital sac is reflected over the cord and its vessels. When one opens a congenital sac he sees projecting from its posterior walls a distinct fold which extends through the entire length of the sac. This fold is produced by the reflection of the peritoneum of the sac about the cord, encircling it in at least one-half to two-thirds of its diameter. This intimate relation between the congenital sac and the cord makes the dissection of the sac more difficult, and one must use more care to avoid injury to the vas deferens or its vessels. If in addition to this intimate anatomical relation there are also adhesions between the sac and the cord, the separation is still more difficult. In these cases the writer is in the habit of leaving a narrow strip of the congenital sac adherent to the cord, rather than attempt its complete excision.

Also in acquired hernia in which the sac is very adherent to the vas deferens and its vessels the writer does not attempt a complete excision, but leaves portions of the sac with the cord at these places where the separation would be too difficult to perform without injury.

As a rule in most cases of acquired hernia (unless a truss has been worn or there have been injections) the separation of the sac from the vas deferens and its vessels is a very simple procedure, especially if this dissection is done from above downwards.

(2). The relation between the sac of inguinal hernia and the round ligament in the female.

In 6 cases the writer has observed the same anatomical relation between the round ligament and the sac that he has just described as being present in congenital hernia in the male. In one of these cases the ovary was descended and held the same relation to the sac as the testicle in a congenital hernia. In the remaining cases of inguinal hernia in the female, which he has operated upon or observed, he has found the anatomical relation to be the same as that of the acquired hernia in the male. From these observations he is led to believe that one may recognize a congenital sac in the female by its anatomical relations to the round ligament. The dissection of the sac from its round ligament in these cases is even more difficult than the dissection of the cord from the congenital sac in the male, and if one wishes to save the round ligament he will

find it the simpler procedure to leave attached to the round ligament the reflected portion of the sac.

In these cases of congenital hernia in the male and female, if one opens the peritoneum above the neck of the sac after the division of the internal oblique muscle and then divides the peritoneum across above the neck of the sac, he will find that the separation of the peritoneum at this position from the round ligament of the cord is much less difficult than below the neck of the sac, and can be done with less danger of injury to the round ligament or *vas deferens* and its vessels.<sup>1</sup>

#### SEC. XVI.—STRANGULATED HERNIA.

##### *Contents of the sac in good condition.*

Inguinal hernia, 31 cases; umbilical hernia, 3 cases; femoral hernia, 12 cases; total, 46 cases. Anæsthetic, cocaine 4 cases: 2 inguinal, 1 femoral and 1 umbilical; all recovered. Anæsthetic, ether 42 cases. Death, 4 cases (9 per cent). Cause of death: pneumonia, 1 case; death on table, gumma of cerebellum, 1 case; coronary arteritis, sudden syncope 10th day, 1 case; acute infection of a hydronephrosis, 1 case. This 9 per cent of deaths in 42 cases of strangulated hernia should be compared with 2 cases of death in 398 cases of non-strangulated herniæ, less than 1 per cent. In 2 of these 4 cases of death (pneumonia and death on the table) the result would with little doubt have been different if cocaine had been used as the anæsthetic.

Many cases of strangulated hernia are in a very critical condition when brought to surgeons for operation, and the chief danger would seem to arise from the use of a general anæsthetic. As will be shown later, before operation it is impossible to ascertain with any certainty whether the constricted intestine is gangrenous or not and for these reasons it might be better in some cases in which the general condition of the patient is bad and the age of the patient is advanced, not to give a general anæsthetic, but to use cocaine. Under cocaine we can open at once into the sac and ascertain the condition of its contents; if gangrenous the intestine is drawn out of the wound. Such an exploratory operation under cocaine prac-

<sup>1</sup> This is the first attempt to describe an anatomical difference between an acquired and a congenital sac in the female. It is of course of no surgical importance.

tically eliminates all the dangers of the operation itself. If the gut is in good condition it can be reduced and a radical operation performed. A few whiffs of ether or chloroform may be required to reduce the intestine, especially in umbilical hernia.

Cushing was the first to use cocaine in this hospital in operations for hernia, and he has reported his cases in the Johns Hopkins Hospital Bulletin, No. 89, August, 1898. The writer, following his suggestion, has used cocaine in two cases of strangulated hernia, 1 femoral and 1 umbilical. Both recovered.

The ultimate results after our 42 operations for strangulated herniæ have been equally as good as after operation for non-strangulated herniæ. In old men it shortens the operation to excise the cord, or to castrate, following the rules discussed in Sec. VIII, page 266.

The writer has noted in a number of cases of strangulated inguinal hernia in the male that the testicle when it has been exposed during the operation was very much congested, and the tissues about the testicle, epididymis and cord oedematous; in some cases the testicle appeared almost cystic. In these cases therefore it is especially contra-indicated to excise the veins.

*Strangulated hernia in which the intestine has been gangrenous and in which a general peritonitis has been present without gangrene. 13 cases.*

Inguinal hernia, 7 in 38 cases (18 per cent) (:) umbilical hernia, 1 in 3 cases (33 $\frac{1}{3}$  per cent) (:) femoral hernia, 5 in 17 cases (28 per cent).

Gangrene or peritonitis is therefore a common condition to find in cases of strangulated hernia. Fortunately these patients during the last two years have been brought to the hospital within much shorter intervals of time after the symptoms of strangulation, and for this reason a gangrenous strangulated hernia is becoming much less common. This is also true of patients suffering from acute appendicitis and general peritonitis. Not only the physician but the patients themselves are recognizing the importance of a very early operation in these two conditions. Quite a number of patients with small, reducible herniæ, which give little, if any, discomfort, come to the hospital for operation because they fear the danger of strangulation.

These 13 cases are classified for study as follows:

(1). Cases in which the patients before operation were in a critical condition and presented all the symptoms of a general peritonitis which was found to be present at the operation, but in which there was no gangrene of the strangulated intestine. 3 cases.

Group XI, Case No. 4. Umbilical hernia; female; age 41 years. Symptoms of strangulation, 6 days. Death ten hours after operation.

Group XIII, Case No. 3. Inguinal hernia; male; age 46 years. Symptoms of acute obstruction, three days. No history nor evidence of any external hernia. Operation, median laparotomy. General peritonitis present. Wound closed. Death, 14 hours. At the autopsy in the left iliac fossa an inguinal hernia was found to be present which had been reduced "*en bloc*."

Group XI, Case No. 6. Femoral hernia; female; age 55 years. Symptoms of strangulation, only 20 hours. During the transportation to the hospital the hernia became reduced. Operation, laparotomy. There was a general peritonitis and the point of the constriction of the intestine was still evident. There was no evidence of gangrene. Death in 36 hours.

This case demonstrated the fact that within 20 hours a general peritonitis may be set up by the strangulation of a portion of the intestines.

(2). General peritonitis following the reduction of a piece of strangulated intestine. One case.

Group XI, Case No. 3. Male; age 60 years. Symptoms of strangulation, 42 hours. General condition fair. At the operation a mass of omentum was excised, but the congested intestine was returned. Death in 36 hours. Autopsy: Acute general peritonitis (*streptococcus*). A small area of the strangulated intestine showed evidence of necrosis, but no perforation.

(3). Gangrene of the intestine. Resection and the formation of an artificial anus. 1 case.

Group XI, Case No. 7. Femoral hernia; male; age 63 years. Symptoms of strangulation, 7 days. General condition critical. 45 cm. of ileum were resected. Death, 3 days. No autopsy.

(4). Gangrene of the intestine. Resection and artificial anus. Secondary resection and end-to-end suture on the 12th day. 1 case.

Group XI, Case No. 1. Male; age 41. Symptoms of strangulation, 5 days. General condition poor. At the first operation

110 cm. of ileum were resected and at the second operation 30 cm. Death in 3 days. Autopsy: General peritonitis; union of suture firm. In this case between the first and second operation an intense dermatitis was set up by the faecal discharge.

(5). Gangrene of the intestines. Resection and immediate end-to-end suture. Wounds closed. 3 cases; all died.

Group XI, Case No. 2. Inguinal hernia; male; age 23 years. Symptoms of strangulation, 24 hours. General condition good. 4 cm. resected and sutured. Death, 11 hours. Autopsy: Acute general peritonitis; union of suture perfect. As far as one could judge this case appeared to be an ideal one for resection and immediate suture. The patient was a young and robust man. His general condition was good. There was no evidence of a general peritonitis at the operation.

Group XI, Case No. 5. Femoral hernia; female; age 59. Symptoms of strangulation, 3 days. General condition critical. Resection of 4 mm. (Littré's hernia). Death in 4 days. Autopsy: General peritonitis; suture firm.

Group XI, Case No. 8. Femoral hernia; female; age 46. Symptoms of strangulation, three days. General condition fair. Resection of 4 cm. and immediate suture. Death, 29 hours. Temperature 107°. At the autopsy there was no evidence of a peritonitis and the suture was firm. A few colon bacilli were found in cultures from the peritoneal cavity.

(6). Gangrene of intestine, conservative operation: 2 cases.

Group XI, Case No. 9. Femoral hernia; female; æt. 61. Symptoms of strangulation, 5 hours. General condition good. At the first operation the gangrenous loop was drawn out of the wound and sutured in place. In 48 hours a small opening was made and a tube introduced. The patient made an uninterrupted recovery. Two months later the faecal fistula was excised and an end-to-end suture was performed. Convalescence uninterrupted up to the 15th day, when there were symptoms of obstruction with fever. A second operation was performed and death followed from peritonitis (see history).

Group XII, Case No. 4. Inguinal hernia; male; age 50 years. This patient had an irreducible hernia of many years' duration. Strangulation of an extra loop which had descended a short distance into the sac and had become gangrenous was present. At the

operation the constriction was relieved and this loop of gut drawn out of the wound and held in place by gauze. The sac was filled with adherent intestine (Photo No. 5). The patient before operation was in a critical condition and died a few hours after. Autopsy showed general peritonitis.

(7). Strangulation in old irreducible hernia.

Group XII, Case No. 2. Male; age 74 years. Very large hernia, had been irreducible five months, and during the last five weeks he has suffered from symptoms of partial obstruction of the bowels. At the operation the intestines were found to be adherent to the sac, but no point of constriction could be made out. An artificial anus was made. Death followed in 24 hours. No autopsy. The patient's condition before operation was critical.

(8). Chronic obstruction of the bowels following the reduction of a strangulated hernia.

Group XIII, No. 2. Inguinal hernia; male; age 35 years. Three and a half months before admission the patient had been operated on for a strangulated, right, inguinal hernia. The wound healed p. p., but ever since the operation he has suffered with symptoms of chronic obstruction of the bowels (see history).

*Relation between the Duration of Symptoms of Strangulation and the Condition of the Contents of the Sac.*

In 1 case of femoral hernia (Group XI, No. 9) the symptoms of strangulation were present but 5 hours, yet the loop of intestine was almost gangrenous.

In 1 case of femoral hernia (Group XI, No. 6) the symptoms of strangulation had been present but 20 hours, yet at the operation a general peritonitis was found to be present, which caused death; there was no gangrene of intestine.

In 3 cases of inguinal hernia in which the intestine was gangrenous, the duration of the symptoms of strangulation was 1 day, 3 days, and 5 days.

In the 3 cases of femoral hernia in which the intestine was gangrenous, the duration of symptoms of strangulation was 5 hours, 3 days, and 7 days (2 cases were 3 days).

In the 24 cases of strangulated hernia in which the circulation of the intestine was so little impaired that it did not contra-indicate its return to the abdominal cavity, the symptoms of strangulation

had been present in 1 case seven days, in 2 cases six days, in 4 cases four days, in 2 cases two days, in 6 cases one day, and in 9 cases less than 24 hours.

In the 8 cases of femoral hernia in which the intestine was reduced and which recovered from the operation, the symptoms of strangulation had been present 1 case, five days; 1 case, three days; 2 cases, one day; and 4 cases, less than 24 hours. A careful reading of the clinical histories of these cases apparently gives no light which could aid us to determine whether the strangulated intestine was or was not gangrenous.

These figures also prove that while in one case gangrene may begin in 5 hours, yet in another case it may not set in after seven days. The operator therefore in every case of strangulated hernia should be prepared to meet and treat gangrene of the intestine.

*The Differential Diagnosis between Strangulated Omentum  
and Strangulated Intestine.*

Of the 3 cases of strangulated inguinal hernia in which the sac contained omentum, 2 had all the symptoms of strangulated intestine. Of 3 cases of strangulated femoral hernia, 2 had all the symptoms of strangulated intestine. In 1 case of inguinal hernia in which the gut was gangrenous, the rupture had been irreducible for 48 hours, and the patient had suffered with intense pain in the tumor, but nausea and vomiting did not set in for 16 hours. The percussion note over an intestinal hernia may be as flat as over an omental hernia, because of fluid; therefore in many cases one cannot make a differential diagnosis between an intestinal and omental hernia.

Our observations covering 13 cases of strangulated hernia in which the constricted gut was gangrenous, or in which there was general peritonitis without gangrene of the intestine, and one case in which general peritonitis followed the reduction of a very congested loop of intestine in which there was no evidence of gangrene at the autopsy, make it seem probable that the resistance of the peritoneum to infection in these cases is lowered.

Thus all of the cases of immediate resection and suture for gangrene have died of general peritonitis. General peritonitis has taken place before the operation without gangrene of the intestine, and cases of resection for gangrene with the formation of an artificial

anus have died either from general peritonitis or in a few days from exhaustion.

In a strangulated hernia in which the intestine is in such a condition that it should not be returned into the abdominal cavity, without doubt the simplest procedure to follow after the relief of the constriction is to draw the loop out of the wound and suture it in place. Later the faecal fistula can be excised and a radical operation performed.

The writer feels that in the majority and perhaps in every case the probabilities of death are much less in this than in any other procedure. He has had one such successful case. The strangulation was situated in the ileum and produced by a band 6 cm. from the cæcum. The operation was performed  $5\frac{1}{2}$  days after the beginning of the attack. The patient's condition was too critical to attempt a resection and suture. The abdominal cavity was filled with blood-stained fluid; 12 cm. of the ileum above the point of constriction were very much enlarged and congested and every evidence of beginning gangrene was present; while the ileum below the point of constriction for a distance of 2 cm. was almost obliterated and covered with fibrin. 14 cm. of the intestine were drawn out of the wound and sutured in place. Five hours later the gut was opened and a tube introduced. Three months later, when the patient was in excellent condition, the faecal fistula and a portion of the ileum up to the cæcum were excised, and a lateral anastomosis made between the ileum and cæcum; the patient made a perfect recovery and is now (August, 1898, 2 years and 3 months after operation) in perfect health. In the second case (Group IX, No. 8) the patient made a perfect recovery from the first operation and was making to all appearances a perfect recovery from the second operation when death took place from a complication, which might happen after any resection and suture of the intestine, whether it was done at a primary or secondary operation.

To resect a portion of gangrenous intestine and perform an end-to-end suture requires time and a good deal of manipulation, no matter how rapid the method of suture may be. The time consuming part of the operation is the excision of the gangrenous gut and the ligation of the mesenteric vessels. During this procedure it is impossible to prevent some infection of the general peritoneal cavity.

The writer is therefore of the opinion that, with few exceptions, in case of strangulated hernia with gangrenous intestine the operator gives his patient the best chance for recovery by doing the conservative operation.

The following three cases are recent:

Group II, Case 23. Male, æt. 32 years. The small, right inguinal hernia had become irreducible twenty-four hours before the patient was admitted to the hospital, and for twenty hours there had been symptoms of strangulation. The condition of the patient was so excellent that it seemed to be a case in which immediate resection and suture could be done. Operation 10-26-'98 (Bloodgood). Ether was given and well taken. The line of demarcation of the gangrenous loop was sharp. The intestine was not distended. Six cm. were excised and an immediate end-to-end suture performed with the aid of a Halsted rubber cylinder. The abdominal wound was closed with the usual suture. The condition of the patient at the end of the operation was excellent. An uneventful recovery followed. Last examination, June, 1899, eight months since operation; the result is a perfect one.

Group XI, Case 10. Male, æt. 62 years. A very large, right inguinal hernia of 40 years' duration became irreducible three days before admission. Symptoms of strangulation began at once. On admission the condition of the patient was fair. There were signs of slight emphysema of the lungs. First operation 2-12-'98 (Bloodgood). Cocaine anaesthesia. About 10 cm. of the ileum including the gangrenous portion were brought out of the wound and sutured in place. It was necessary to ligate and excise a large mass of the omentum. The very large sac was removed with the testicle and a hydrocele. Culture and coverslip from the fluid in the sac and from the peritoneum of the gangrenous loop were sterile. Twenty-eight hours later I considered that it might be better to resect and suture rather than wait a number of weeks and then operate in the presence of a faecal fistula. The condition of the patient had improved. He had slept quietly most of the night and had taken nourishment. It was found that the handling of the loop of intestine now adherent to the parietal peritoneum was so painful that chloroform was administered and the attempt to resect without an anaesthetic given up. Chloroform was administered but 35 minutes. The resection was rapidly done. The

only difficulty was due to the thickening of the mesentery. An end-to-end suture was made with the aid of the Halsted rubber cylinder<sup>1</sup> and the wound closed in the usual way. The condition of the patient at the end of the operation appeared to be excellent. Death took place in two and one-half days. There were symptoms of pneumonia but none of peritonitis. Nourishment was retained and flatus and faecal matter were passed. Autopsy No. 1212. Anatomical diagnosis (Dr. McCallum). Operation wound, no evidence of infection, end-to-end suture of the intestine apparently perfect, very slight localized peritonitis over the mesentery and about the area of suture. Very extensive broncho-pneumonia (see history).

Group XI, Case 12. Male, aet. 76 years. The patient was admitted to the ward March 16, 1899. A large, right inguinal hernia had been present 17 years. Four days before admission the hernia became irreducible and symptoms of strangulation began in a few hours. The general condition of the patient was not very good. Operation at once (Cushing). Anæsthetic, cocaine. The sac contained a small loop of ileum pinched at the omental edge. A wedge-shaped area appeared to be almost gangrenous. This loop was drawn out of the peritoneal cavity and sutured in the wound. The cultures from the fluid in the sac were sterile. Forty-eight hours later symptoms of obstruction began which were not relieved by opening the intestine. With cocaine anæsthesia Doctor Cushing resected and made an end-to-end anastomosis. The wound was closed without drainage. The patient died three days later. Autopsy. Broncho-pneumonia of the left lung and infarction of the right lung. No peritonitis. Suture firm.

This case and the former one (Group XI, Case 11) are very much alike. In Case 10 we attributed the pneumonia to the chloroform.

#### *Leucocytosis in Strangulated Hernia.*

Doctor Cushing in August, 1898, observed a leucocytosis of 20,000 in a case of obstruction following an operation for typhoid perforation. Recovery followed the second operation for the obstruction. Peritonitis was not present. (Reported in the Johns Hopkins Bulletin No. 92, November, 1898, page 9.) Doctor Fin-

<sup>1</sup> Philadelphia Medical Journal, vol. ii, No. 2, January, 1898.

ney later observed a leucocytosis of 19,000 in a similar case which also recovered from the second operation.

Since Doctor Cushing's first observation a leucocyte count has been made in every case of obstruction. So far a leucocytosis has been present.

In two cases of volvulus the leucocyte counts were 15,000 and 19,000. The first was relieved without an operation; the second by an operation. Neither peritonitis (cultures sterile) nor gangrene was present.

In three cases of strangulated hernia in which the gut was gangrenous the leucocytoses were 20,000, 21,400 and 22,150. In one case in which gangrene was not present the count was 17,300.

A recent case of interest, demonstrating, perhaps, the diagnostic value of the leucocyte count (Group I (A), Case 21), was admitted March 14, 1899. The following history was obtained. Four days before admission a large, left inguinal hernia, which had been present, and always reducible, eight years, became irreducible with symptoms of strangulation beginning at once. The hernia was reduced by taxis. Later it became irreducible again and reduction was accomplished under chloroform. However, only after a prolonged effort. The symptoms of obstruction were not relieved and the patient was brought to the hospital. Examination by Dr. Cushing: "Male, aet. 60 years. Patient evidently much exhausted. No signs of collapse or shock. Abdomen soft, slight distention. An indistinct mass was felt in the left iliac fossa, supposed to be the hernia reduced 'en bloc.' Visible peristalsis unassociated with cramp." Leucocyte count 6000. For this reason (no leucocytosis) Doctor Cushing delayed operation. In a few hours the patient began to pass gas and the symptoms of obstruction disappeared. Four days later the operation for hernia was done. The sac was empty.

Further observation should be made on this condition. These few cases seem to show that a leucocytosis is present in acute obstruction without peritonitis and without gangrene.

## SEC. XVII.—AGES OF PATIENTS OPERATED ON FOR HERNIA.

Years.	Inguinal. Males.	Females.	Umbilical.	Femoral.
1- 5	23	0	1	0
5-10	20	4	1	0
10-15	18	3	0	0
—	—	—	—	—
Total, 1-15	61	7	2	0
15-20	22	7	0	0
20-30	85	9	3	3
30-40	68	6	6	4
40-50	53	8	7	12
50-60	34	2	2	8
60-70	14	0	3	4
74-75	2	0	0	0
83	1	0	0	0
—	—	—	—	—
Total, 15-83	279	32	21	31
Grand total, 340		39	23	31

The youngest patient (Group I, No. 217) was a male child, æt. 13 months. The hernia was large and strangulated, and the sac contained the cæcum and appendix; the latter was removed. Ether was the anaesthetic. The recovery was uneventful. The ultimate result is a perfect one; last examination July 22, 1896, 6 months since operation.

The oldest patient (Case No. 27, Group IV) was 83 years and 6 months of age. The hernia was very large. There was also a large hydrocele. The operation was performed with cocaine. The recovery was without complication. Last examination September 1, 1898, 1½ months after operation; perfect result.<sup>1</sup>

The next oldest, 75 years (Case No. 18, Group IV), was operated upon under ether. The condition of the patient before operation was excellent. Convalescence uneventful. August, 1898, examination; perfect result, 1 year and 8 months since operation.

In patients over 50 years of age suffering from non-strangulated

<sup>1</sup> November, 1898. Three weeks ago this patient was operated on again under cocaine for a small, left inguinal hernia and has made an uninterrupted recovery; the wound healed per primam.

hernia, we have selected our cases because of the possible danger from the anæsthetic. However, now that we have demonstrated the ease with which the operation, even in very large herniæ, can be performed under cocaine, we shall without doubt operate more frequently henceforth on these older patients.

Thus far three operations have been performed under cocaine for non-strangulated hernia; one aged 83 years, two aged 67 years. The results have been just as satisfactory as if the operation had been under ether.

SEC. XVIII.—HERNIA IN CHILDREN BETWEEN THE AGES OF 13 MONTHS AND 15 YEARS, 68 CASES.

Years.	Males.	Females.
1- 5	23	0
5-10	20	4
10-15	18	3
	—	—
	61	7

Death, 1 case (Group I, Case No. 113), boy aged 6 years, on the 7th day from acute colo-proctitis (see history).

Healing of the wound in 62 cases in which the wound was closed: per primam 57 cases; suppuration 5 cases (8 per cent). Acute infection 3 cases (Group I, No. 34; Group III, No. 1, and Group IV, No. 14). In Case No. 34 hernia strangulated; the skin prepared hurriedly on the table. In the remaining 2 cases the operations were difficult. Secondary stitch abscesses 2 cases (Group I, Nos. 1 and 23).

METHOD OF OPERATION AND ULTIMATE RESULTS.

Group.	Perfect results, 1 to 9 yrs.	Recent.	Lost.
I. Cord transplanted	37	2	8
II. Cord not transplanted	2	0	0
III. Cord excised	1	0	0
IV. Castration	2	0	1
V. Female	4	3	0
VI. Bassini	0	1	0
	—	—	—
	46	6	9
VII. McBurney's op.,	6 cases;	recurrences, 2 cases.	

In children in which the wounds had been closed there has been no recurrence. In 46 cases from 1 to 9 years have passed since operation. In 5 of these cases the wound suppurated; four are perfect results, 2 to 6 years after operation, and one has been lost sight of.

The 2 cases of recurrence were after a McBurney operation. In one a second operation was performed. Group II, No. 2, the result is a perfect one, 6 years and 9 months after operation.

TABLE OF SIZE AND VARIETY OF HERNIA IN CHILDREN.

Congenital, 23 cases.      Acquired, 45 cases.

	Complete.	Incomplete.	Complete.	Incomplete.	Total.
Very large	3	0	1	0	4
Large	2	0	5	0	7
Medium	3	0	3	2	8
Small	7	8	15	19	49
	—	—	—	—	—
Total	15	8	24	21	68

Direct hernia, no cases.

Conjoined tendon obliterated, no cases.

Reducible hernia, 62 cases.

Strangulated hernia, 4 cases (Group I, Nos. 12, 34 and 217, and Group II, No. 5); all recovered; all males.

Irreducible hernia, 2 cases (Group I, No. 134, due to fluid, hydrocele of the sac; Group I, No. 41, due to adherent omentum).

Contents of the sac (see Sec. XIV):

a. Cæcum and appendix, 4 cases (Nos. 1, 58 and 217, Group I, and No. 5, Group II).

b. Appendix, 1 case (Group I, No. 148).

c. Intestine, 1 case (Strangulated Group I, No. 34).

d. Omentum not adherent, reduced, 3 cases.

e. Omentum adherent, reduced, 2 cases.

f. Omentum adherent, excised, 1 case.

g. Ovary, 1 case (Group V, No. 38).

h. Properitoneal fat, no cases.

i. Sac not opened, 3 cases.

j. Sac empty, 60 cases.

Double inguinal hernia, 2 cases (Group I, Nos. 57-58 and 88-89). Case No. 57-68 also had an umbilical hernia (see Photograph No. 3).

The operation for hernia in children is, in our experience, a very simple one. The sac in one-third of the cases is congenital and the opening produced by the rupture in the majority of cases is small. The conjoined tendon in all of our cases was wide and firm, and the internal oblique muscle thick. The veins accompanying the cord are small. Without much doubt a simple excision of the sac and suture of the wound, including the internal oblique muscle, will accomplish a cure in every case. Our observation demonstrates that it is especially contra-indicated to excise the veins in children.<sup>1</sup>

#### SEC. XIX.—OPERATION FOR HERNIA UNDER COCAINE ANÆSTHESIA.

Judging even from our few observations, the use of a local anæsthetic in strangulated hernia is especially indicated. In 18 per cent of strangulated inguinal herniæ, 28 per cent of femoral and 33 per cent of umbilical herniæ, the intestine has been gangrenous or a general peritonitis has been present, and in 25 per cent of these cases (4 in 16 cases) a broncho-pneumonia has been found at autopsy. Ether was the anæsthetic in every case.

In these cases I believe the operation should consist only of a simple incision, relieving the constriction and bringing the gangrenous gut out of the wound. Such an exploratory operation can easily be performed under cocaine.

The skin incision, the division of the aponeurosis of the external oblique muscle and the internal oblique muscle, the opening of the peritoneum above the neck of the sac, and the division of the constriction and of the sac from above downwards, as described in Sec. V, can be done under cocaine anæsthesia of the skin with very little discomfort.

In 42 cases of strangulated hernia in which the condition of the contents of the sac allowed its reduction, there have been 2 deaths (4.6 per cent), which should be attributed to the ether. Pneumonia, 1 case (2.3 per cent); and one death on the table (gumma

<sup>1</sup> March, 1899. We have just observed an atrophy of the testicle in a child. The veins had been excised, but following the operation there was noted no evidence of an epididymitis. Atrophy did not become evident until one year after operation, and was not complete until two years. The case is the only example of atrophy without a very marked epididymitis following operation.

of the cerebellum)—while in 376 operations for non-strangulated hernia there have been no deaths directly due to ether. There have been 5 cases of pneumonia (1.3 per cent); 2 of these died later of tuberculosis of the lungs (less than 1 per cent).

These observations should certainly influence us to use cocaine in many, if not in all, cases of strangulated hernia. If the gut is in good condition it may be necessary to give a few whiffs of chloroform to reduce it and to complete the radical operation.

Cushing<sup>1</sup> reports 3 cases of strangulated hernia on which he operated with cocaine: Group II, No. 15. Large, left inguinal hernia; symptoms of strangulation, 48 hours; adult; male; æt. 53 years. The entire operation was performed with morphia and cocaine. The usual incision, the opening of the sac and the reduction of its contents (intestine and omentum) were accomplished with very little discomfort to the patient. The excision of the sac and the suture of the wound were painful, and the suture not satisfactory to the operator. Six weeks later, under ether narcosis, a radical operation was performed. In a second case (Group III, No. 17, a large, left inguinal hernia with symptoms of strangulation for 6 hours; colored man; æt. 39 years) Cushing did the exploratory operation with cocaine, reducing the 18 inches of small intestines. The remainder of the operation was finished under primary chloroform.

He reports a third case, a femoral hernia in a feeble woman with symptoms of strangulation of three days' duration. The entire operation was done with cocaine and without any assistant, away from the hospital. The wounds in these cases healed p. p.

The writer has used cocaine in 2 cases of strangulated hernia with perfect satisfaction. The first case (Group X, No. 25) was a medium-sized femoral hernia with symptoms of strangulation for 5 days. The patient was a female, æt. 50 years, whose condition before operation was extremely feeble. Morphia was given hypodermically and the sac opened with cocaine anæsthesia. It was then found necessary to give a few whiffs of chloroform during the division of the constriction and the reduction of the intestine. The usual radical operation was performed. The wound healed per primam. Immediately after operation the nausea and vomiting

<sup>1</sup>The Johns Hopkins Bulletin, No. 89, August, 1898.

ceased and the patient began at once to take nourishment. Three years ago I operated on a similar case in the country under ether narcosis. The patient, whose condition did not seem to be as critical as the one just reported, died 3 days after the operation.

My second case was a very difficult one (Group IX, No. 21). The patient, a very fat woman, aet. 52 years, weight 250 lbs. She had suffered from a very large, umbilical hernia for 38 years, and during the last 4 days symptoms of obstruction had developed. This patient gave a history of attacks of dyspnoea associated with oedema of the legs. For three days before admission the quantity of urine secreted was very much diminished. The operation was performed with morphia and cocaine. An incision 28 cm. long was made without pain. The subcutaneous fat was 5 cm. in thickness. The sac contained the cæcum, colon and a mass of small intestine. During the reduction of the intestines a few whiffs of chloroform were given and a radical operation performed. The symptoms of obstruction immediately disappeared and the patient for the first time in three days retained nourishment. She continued, however, to be very ill for five days. The amount of urine secreted measured from 80 to 260 cc.; it contained a trace of albumen but no casts. It is a question if the result would have been the same under an ether or complete chloroform narcosis.

*Non-strangulated hernia, 3 cases.*

(1). Group III, No. 16. Male; aet. 67 years. Large, right inguinal hernia. Operation 21-4-'98 (Cushing).

(2). Group III, No. 18. Male; aet. 67 years. Small, left inguinal hernia. Operation 8-6-'98 (Bloodgood).

(3). Group IV, No. 27. Male; aet. 83 years and 6 months. Very large, right inguinal hernia and hydrocele. Operation 7-6-'98 (Bloodgood).

In the first 2 cases the cord was excised; in the last the testicle was removed. In the 2 latter cases the rectus muscle was transplanted. The operations in these cases were just as satisfactory for a radical cure as in cases in which ether had been the anæsthetic. The operation in the last case was a very difficult one (see Photo No. 1). The wound in each case healed per primam.

In these 3 cases the patients were given their breakfast. Just before the cocaine was injected morphia gr.  $\frac{1}{6}$  was given hypodermically. The skin incision was then injected with about 3 ii of a

1 per cent solution of cocaine and 5iv of boiled water. This completed the local anæsthesia.

In the writer's 2 cases the patients made no complaint during the skin incision, the division of the aponeurosis of the external oblique, the opening of the sac, the division of the sac above the neck and its closure.<sup>1</sup> During the ligation of the veins they complained of pain, and during the separation of the sac some discomfort. The transplantation of the rectus muscle and the introduction of the suture were almost painless. When the deep sutures were drawn home, the patients complained of pain. The introduction of the continuous subcutaneous sutures gave some discomfort because the effect of the cocaine had disappeared.

The first patient, a colored man, had been operated on four years before under ether narcosis for a strangulated hernia on the right side. He expressed a preference for the cocaine operation.

The second patient, æt. 83 years, was a physician and a very intelligent old man: during the operation, which was performed with great deliberation and lasted 1 hour and 20 minutes, we carried on a conversation, the patient at each step telling the operator the painful and the painless parts. The periods of pain were few and the duration was very short, 10 to 20 seconds. During the operation the patient was given coffee and a little whiskey and water to drink.

The experience and the results in these 3 cases have convinced me of the perfect feasibility of a very satisfactory radical operation even for very large herniæ with local anæsthesia. Heretofore we have advised against operation in many cases because of the age and general condition of the patient, fearing the danger of ether or chloroform narcosis. Further experience with cocaine will no doubt diminish and perhaps entirely remove these contra-indications for operation. If this proves true, the field of operation for hernia will be enlarged and many old and feeble patients will be relieved, without risk, of the discomforts of a rupture which in many cases make old age almost unendurable.

Recently we have operated on four more cases of inguinal hernia under cocaine anæsthesia.

Group I (A), No. 2. Male, æt. 24 years. The hernia was small and reducible. The veins were transplanted in the divided internal oblique muscle, the remainder of the cord was left undisturbed;

the separation and transplantation of the veins were painless. Two important points were learned: (1) The division of the internal oblique muscle is very painful unless the hypogastric branch of the ilio-hypogastric nerve is injected with cocaine. The nerve is situated along the lower border of the muscle and is easily found. (2) In this case the skin incision was made lower than usual, and the subcutaneous nerve accompanying the superficial external pudic artery was inadvertently divided. The pain was intense for a moment. The patient almost jumped off the table.

Group III, No. 20. Male, *aet.* 84 years. The hernia was small and reducible; the cord was ligated and excised. The patient had been operated on on the right side for a very large hernia some few months before (see Group IV, No. 27). He suffered very little during the operation. The wound healed per primam.

Group XI, No. 10. Male, *aet.* 62 years. The hernia was very large and had been strangulated three days. The gut was gangrenous. At this operation a very large mass of the omentum was ligated and excised. The very large sac was removed with the testicle and a hydrocele. The gangrenous gut was left out of the wound. The operation gave very little pain, and shock did not follow. The vomiting present before operation ceased and the patient immediately took nourishment. 28 hours later with chloroform anaesthesia the loop of ileum was resected and sutured. Death from broncho-pneumonia took place in two and one-half days (see history).

Note.—February 20, 1899, at the Johns Hopkins Hospital Medical Society, Doctor Cushing reported 17 cases of operation for hernia under cocaine anaesthesia; these 17 cases included the 10 just reported in this section. The first operation for hernia under cocaine anaesthesia was performed by Cushing in January, 1897. Since this date there have been 125 operations for hernia, including the 17 cases under cocaine anaesthesia. There have been no bad results or suppurations of the wound following the local anaesthetic.

SEC. XX.—OBSERVATION ON THE SWELLING OF THE TESTICLE AND  
INDURATION OF THE EPIDIDYMIS WHICH HAVE FOLLOWED  
OPERATIONS FOR HERNIA.

This temporary swelling and induration is almost always associated with tenderness and clinically resembles an ordinary epi-

didymitis. Our observations have demonstrated that the *excision of the veins*, with very few exceptions, is the cause of this epididymitis, and that *atrophy of the testicle* has resulted only in those cases in which the epididymitis has been very marked and (with one exception) in which the veins have been excised.

Number of cases for study	241 cases.
Group I. Cord transplanted	206
II. Cord not transplanted	14
III. Cord and veins excised	14
IV. McBurney's operation	7

These 241 cases have been divided into the following classes:

*Class 1.* Cases in which there is no note on the condition of the testicle and epididymis following operation. These cases are all among the early operations, during which time attention had not been especially called to the condition of the testicle.

Group I. Halsted's operation	61 cases.
(a) Veins not excised	44
(b) Veins excised	17

The ultimate result of 40 of these cases is known at the present date, and in not one case has atrophy of the testicle followed the operation.

Group II. Cord not transplanted, veins not excised, 5 cases.

The ultimate result of 3 cases is known; no atrophy of the testicle; 2 cases have been lost sight of since operation.

Group III. Cord and veins excised, 4 cases.

The ultimate result is known in 3 cases; no atrophy; 1 case lost sight of since operation.

Group VI. McBurney's operation, veins not excised, 7 cases.

The ultimate result is known in 6 cases; no atrophy; 1 case lost sight of.

*Class 2.* Cases in which there is a careful note stating that no swelling of the testicle or induration of the epididymis followed operation.

Group I. Halsted's operation	53 cases.
(a) Veins excised	11
(b) Veins not excised	42

The ultimate result of the majority of these cases is known; the testicle is normal in every case.

Group II. Cord not transplanted. Veins not excised, 3 cases.

The ultimate result is known in these 3 cases; testicles normal.

Group III. Cord and veins excised, 1 case.

The testicle in this case was atrophied before operation; no change has followed the operation; last examination 5 weeks after operation.

In the 11 cases in Class 2 of Halsted's operation, in which the veins *were excised* and in which no epididymitis followed operation, the method of excision of the veins was that described in this paper.

*Class 3.* Cases in which within 24 to 36 hours after operation the testicle became swollen and tender. In some few cases there was also some slight œdema of the scrotum; this temporary swelling disappears gradually in a few days, and then the epididymis is found to be slightly indurated; this induration disappears completely in from 1 to 3 weeks. If the veins have been excised there is also after 24 to 48 hours a temporary swelling of the veins below the ligated stump. In a few cases the blood in the veins coagulates, and one feels an indurated mass extending from the point of ligation to the epididymis. In the majority of cases, however, the veins do not become thrombosed, and the temporary swelling disappears in from 1 to 3 weeks. If the veins become thrombosed the indurated mass gradually disappears in from 3 to 8 months. The induration about the ligated stump is the last to become absorbed; this takes place in from 6 months to 2 years.

In at least 40 per cent of these cases the temporary swelling or induration of the veins is all that one can make out even after the most careful examination. The tenderness of the testicle usually disappears in from 3 to 5 days.

Unless frequent and careful examinations are made of the testicle after operation this temporary swelling and induration would be overlooked. As shown in the following table this condition may follow the operation for hernia in cases in which the veins have not been excised:

Class 3. Number of cases, 62.

Group I. Halsted's operation, veins excised	44 cases.
"        "    veins not excised	14
II. Cord not transplanted; veins excised	2
III. Cord and veins excised	2

The ultimate result in all these 62 cases is known with few exceptions, and in every case examined the testicle and epididymis are normal. In the 44 cases of Halsted's operations in which the veins were excised, in 38 cases the method of excision was that described in this paper; in 6 cases the older method was followed.

*Class 4.* Cases in which the swelling of the testicle and induration of the epididymis and the thrombosis of the veins have not disappeared until 2 or 3 months, and in some few cases not until 1 year after operation.

*In all of these cases the veins were excised.*

Class 4. Number of cases, 26.

Group I.	Halsted's operation, veins excised	25 cases.
II.	Cord not transplanted, veins excised	1

The ultimate result in these 26 cases is known by examination with 3 exceptions. Atrophy of the testicle has not taken place in any case. The method of the excision of the veins in 23 of these cases was that which was first employed at the operation for hernia; in only 3 cases was the method described in this paper followed.

*Class 5.* Cases in which the swelling of the testicle and induration of the epididymis and veins have been much more marked than in Class 4.

Number of cases, 20.

In 19 cases the veins were excised after the older method. In 1 case the veins were not excised, but became thrombosed after the operation. Atrophy of the testicle has taken place in 16 cases; complete resolution in 4 cases.

In 4 cases the herniæ were small and dissection not difficult. In 16 cases the herniæ were large and the sac very adherent to the cord and testicle; *in all of these cases during the operation the testicle was drawn out of the scrotum.* In all of these cases within a few hours after operation the scrotum became very much distended and there was some œdema of the scrotum and penis. In the majority of cases there was ecchymosis of the scrotum and penis, and in a few cases the ecchymosis of the skin extended up about the wound in the abdomen. In 10 cases there was every evidence of a large haematoma in the scrotum. In 4 of these cases an abscess formed in the scrotum and was opened. In view of the rapid swelling and the formation of distinct tumor in

the scrotum in all of these cases, the writer is of the opinion that in every case there was either hemorrhage from the stump of the ligated veins forming a distinct haematoma or extensive extravasation of blood from some injury of the veins, which infiltrated all the tissues about the stump of the veins, the epididymis and testicle.

In these cases after the first acute swelling and oedema have disappeared the scrotum is filled with an indurated mass, pyriform in shape, in which the testicle, epididymis, vas deferens and veins cannot be differentiated.

Atrophy usually takes place in from 3 to 8 months; in two cases the testicle completely disappeared. In the remainder of the cases it is from one-third to one-half smaller.

In the 4 cases in which resolution took place, the induration of the epididymis and the veins about the vas deferens did not completely disappear until 1 year after operation.

Class 5. Number of cases, 20.

Group I. Halsted's operation, veins excised	10 cases.
(a) Followed by atrophy	7
(b) Followed by resolution	3
Group II. Cord not transplanted	
(a) Veins excised (atrophy)	2
(b) Veins not excised (atrophy)	1

This case (b, Group II, No. 9) was a very large, reducible hernia in an old man; the sac was very adherent to the cord and to the bladder, and during the dissection the veins may have been injured. Directly after operation there was an acute swelling in the scrotum, with every evidence of either a haematoma or extensive extravasation of blood. Atrophy of the testicle followed in 8 months.

Group III. Cord and veins excised	7 cases.
(a) Followed by atrophy	5
(b) Followed by resolution	1
(c) Sloughing of testicle and area of scrotum	1

This case (c, Group III, No. 15) is the only one in the entire series of 241 operations for hernia in which the testicle has sloughed. The hernia was very large and the sac very adherent to the cord and testicle; during the operation the testicle was drawn out of the scrotum. Directly after operation a large haematoma formed in the scrotum, and the entire skin incision was opened in 36 hours;

the wound was distended with blood-stained serum which contained many cocci. Temperature 105.

#### *Conclusions.*

(1). Atrophy of the testicle has followed operations for hernia in which the veins have not been excised in only *one case* (Group II, No. 9), already described. In many of these cases the herniæ have been large and sacs very adherent. Number of operations for hernia in which *the veins have not been excised*, 109 cases. The condition of the testicle after these operations has been as follows:

Group	I.	Halsted's operation	100 cases.
Class	1.	No note (early cases)	44
	2.	No swelling	33
	3.	Slight epididymitis	23
Group	II.	Cord not transplanted; veins not excised.	
Class	1.	No note (early cases)	5
	2.	No swelling	3
	5.	Hæmatoma; atrophy (Group II, No. 9)	

The ultimate result in the majority of these cases is known at the present date.

This table proves conclusively that after operations for hernia in which the veins have not been excised slight epididymitis follows only in about 23 per cent of the cases, and atrophy of the testicle in only 1 of 109 cases. In the 23 cases in which the slight epididymitis followed the operation the herniæ were either congenital or of large size, with a sac adherent to the cord, and in which during the operation the testicle was drawn out of the scrotum.

(2). Distinct atrophy of the testicle has only taken place in those cases in which immediately after operation there has been a very rapid formation of a tumor in the scrotum with every evidence either of a hæmatoma or extravasation of blood, and in 4 cases complicated by suppuration; *in only one of these 16 cases were the veins not excised* (Group II, No. 9).

(3). That the veins may be excised at the operation for hernia with very little danger of a marked epididymitis and practically no danger of a macroscopic atrophy of the testicle, is clearly demonstrated by the results in 53 cases of hernia in which at the opera-

tion the veins were excised after the method described in this paper, page 237.

Group	I.	Cord transplanted, veins excised	51 cases.
Class	2.	Absolutely no change	11
	3.	Only slight epididymitis	37
	4.	Marked epididymitis	3
Group	II.	Cord not transplanted; veins excised	2
Class	3.	Slight epididymitis	2

The ultimate result of all these cases, with a few exceptions, is known from 2 years to a few months after operation. In every case examined the epididymis and testicle are normal. However, in the majority of cases the herniae were small, and in only 2 of 3 cases was the testicle drawn out of the scrotum during operations. (June, 1899. No atrophies observed.)

(4). The immediate and ultimate condition of the testicle in the 61 cases in which the earlier method of excision of the veins was employed has been as follows:

Group	I.	Cord transplanted, veins excised, 58 cases.
Class	1.	No note, 17 cases; ultimate result, no atrophy.
"	2.	No change; no cases.
"	3.	Slight epididymitis, 6 cases; ultimate result, no atrophy. (June, 1899, one atrophy.)
"	4.	Marked epididymitis, 22 cases; ultimate result, no atrophy.
"	5.	Very marked epididymitis, 22 cases; ultimate result, atrophy 7 cases, resolution 3 cases.
Group	II.	Cord not transplanted; veins excised, 3 cases.
Class	4.	Marked epididymitis, 1 case; ultimate result, no atrophy.
"	5.	Very marked epididymitis, 2 cases; ultimate result, atrophy 2 cases.

These results clearly demonstrate that this method of excision of the veins should not be employed. In these 58 cases the method was as follows: After the skin incision the external ring was exposed, the aponeurosis of the external oblique divided, the operator then inserted his hand from without inwards, beneath the contents of the inguinal canal, completely separating the cord and sac with its coverings from the surrounding tissue; this mass was then held upwards, after which the coverings of the

sac were divided, the sac isolated, the larger bundle of veins separated from the vas deferens, ligated and excised. This method is a very rapid and convenient one, but subjects the vas deferens and its accompanying vessels to a good deal of traumatism. The vessels in the meso-cord (described on page 238) are completely torn. At this time it was our endeavor to reduce the size of the cord, so that in the majority of cases the vas deferens was almost completely stripped of its vascular constituents; our observations had not yet demonstrated the dangers of such a manipulation of the cord plus the excision of the veins.

(5). These observations demonstrate conclusively that after complete section and ligation of the vas deferens and all its vessels (if it is performed with great care) there may follow no change in the testicle, only a very slight and temporary epididymitis; only in those cases in which there has been evidence of a distinct haematoma or extravasation of blood producing a very marked epididymitis does atrophy of the testicle follow.

Group III. Complete excision of the cord and vas deferens, 14 cases.

Class	1.	No note, 4 cases; ultimate result, no atrophy.
	2.	1 case; ultimate result, no change. In this case the testicle was atrophied before operation.
	3.	Slight epididymitis, 3 cases; ultimate result, no atrophy.
	5.	Very marked epididymitis, 7 cases; atrophy 6 cases, sloughing of testicle 1 case.

Without very much doubt, in the majority of the 58 cases in which the veins were excised by the older method, the blood-supply of the testicle was just as much shut off as in these 14 cases in which a complete section of both the vas deferens and its vessels was performed.

(6). The transplantation of the cord seems to have no influence whatever on the swelling of the testicle if the veins are not excised.

Group II. Cord not transplanted; veins not excised, 9 cases.

Class	1.	No note, 5 cases; ultimate result, no atrophy.
"	2.	No change, 3 cases; ultimate result, no atrophy.
"	3.	Haematoma of scrotum, 1 case; atrophy. In this case the veins were injured as already described (Case No. 9).

Group II. Cord not transplanted, veins excised, 5 cases.  
Class 3. Slight epididymitis, 2 cases; ultimate result, no atrophy.  
In these two cases the veins were excised as described in the operation for varicocele, page 351. The vas deferens and its accompanying vessels were not disturbed in their position in the inguinal canal.  
" 4. Marked epididymitis, 1 case; ultimate result, no atrophy.  
" 5. Very marked epididymitis, 2 cases; atrophy, 2 cases.

In these 3 cases the veins were not only excised, but the vas deferens and its accompanying vessels were completely separated from their attachments in the inguinal canal, and during the operation the testicle was drawn out of the scrotum; and in the 2 cases in Class 5 there was evidence of extravasation of blood in the scrotum after operation.

(7). There seems to be no good reason to believe that the transplantation of the vas deferens interferes with its function. One of our cases demonstrates that the cord may be transplanted on both sides in the operation for hernia and its function not injured (Case No. 32 and No. 69, Group I). This patient was operated on for hernia first on the right side, but the veins were not excised; and 2 years later on the left side, when the veins were excised. Following the second operation there was a slight epididymitis. About 1 year after the second operation patient's wife became pregnant, and has since borne a child.

#### SEC. XXI.—OPERATION FOR VARICOCELE.

##### *Incision in the scrotum, 16 cases.*

The immediate and ultimate results in these 16 cases were as follows:

No note, 7 cases; ultimate result, hydrocele 1 case, lost track of 6 cases.

No epididymitis, 1 case; ultimate result (exam.), no atrophy.

Slight epididymitis, 2 cases; ultimate result (exam.), no atrophy.

Marked epididymitis, 3 cases; ultimate result (exam.), no atrophy 1 case, lost track of 2 cases.

Hæmatoma, 3 cases; atrophy 1 case; lost track of 2 cases.

The ultimate result, therefore, in these 16 cases after operation for varicocele in which the incision was made in the scrotum is as follows:

Lost track of since operation	10 cases (62%).
Testicle normal	4
Small hydrocele, testicle normal	1
Complete atrophy of the testicle	1

*Operations for varicocele, incision in groin, 29 cases.*

The immediate and ultimate results are as follows:

*No note, 1 case; ultimate result, no atrophy.*

No epididymitis, 6 cases; ultimate result, no atrophy in 2 cases, lost track of 4 cases.

Slight epididymitis, 19 cases; ultimate result, no atrophy 7 cases; hydrocele 5 cases; lost track of 7 cases.

Marked epididymitis, 3 cases; ultimate results, no atrophy 2 cases; lost track of 1 case.

Hæmatoma, no cases.

The ultimate result in these 29 cases in which the veins were excised through incision in the groin is as follows:

Lost track of, or recent cases	12 (41%).
No atrophy of testicle (6 cases examined and 6 cases heard from by letter)	12
Hydrocele	5
Atrophy of testicle	0

Healing of wounds, scrotal incision, per primam, 12 cases; suppuration, 4 cases.

Healing of wound, incision of groin, per primam, 27 cases; suppuration, 2 cases.

The results after the operation for varicocele in which the veins have been excised through an incision in the groin have been better than those in which the veins have been excised through the incision in the scrotum.

After the scrotal incision, there have been 3 cases of its distention with blood; in 1 of these cases the testicle has atrophied; the other 2 cases have been lost track of. There has been 1 case of hydrocele, or 20 per cent of the cases whose ultimate result is known. The healing of the wound has not been as good after operations

(scrotal incision) as after operation for varicocele, groin incision. There has not been one case of very marked epididymitis due to haemorrhage (Class V), and not one case of atrophy of the testicle after operations by groin incision. The number of hydroceles has been 5, or 28 per cent; a larger per cent than after the operation in which the incision was made in the scrotum. The size of each of these 6 hydroceles is small; only one has given sufficient discomfort to demand operation.<sup>1</sup>

*Description of the operation for varicocele by excision of the veins through an incision in the groin similar to the incision for hernia.*

The skin incision should be about 4 to 5 cm. in length and correspond in position to the lower two-thirds of the incision for hernia. After the division of the skin and fascia 2 retractors are placed in the lower angle; these dislocate the skin incision downwards towards the pubes and fully expose the external ring. The different layers of fascia covering the cord are picked up and carefully divided; as soon as the infundibuliform fascia is divided the larger bundle of veins is exposed; this is picked up with two artery clamps and drawn out of the wound. The veins are ligated and excised as described in the operation for hernia, page 237. The vas deferens and its accompanying vessels are not disturbed from their position in the inguinal canal; the skin wound is closed with buried suture of silver wire.

In 3 cases, during the excision of the veins through the incision in the groin, the vas deferens and its accompanying vessels were torn from their bed in the inguinal canal and subjected to more traumatism than they would have been if they had been left undisturbed in the inguinal canal. It was only in these 3 cases that marked epididymitis followed the operation.

The operation for varicocele is not one which should be performed unless the veins are large and unless the condition gives the patient a great deal of discomfort, and it is an operation which should not be performed on young men, at least not until palliative treatment has been given a trial. If the operation is performed, the excision of the veins through an incision in the groin after the

<sup>1</sup> The greater percentage of hydroceles after the incision in the groin may be explained by the fact that 62 per cent of the cases of scrotal incision have been lost track of.

method described in this paper will give the best results, although in a certain number of cases a small hydrocele will form. The hydrocele in the majority of cases will, if allowed to remain, give much less discomfort than the varicocele did before the operation.

If the veins of the varicocele are excised as described in this paper, the immediate change in the testicle after the operation should be very slight, but as yet we have no positive proof that even this slight disturbance of circulation in the testicle may not in some few cases destroy the function of the testicle without producing a macroscopic atrophy.

Our observations after both the operation for varicocele and for hernia in which the veins have been excised demonstrate that macroscopic atrophy has followed only in those cases in which a very marked epididymitis has taken place directly after operation. In a few cases the veins have been excised on both sides: in 1 patient for a double varicocele; in 2 patients for varicocele on the left side and a hernia on the right side. In these 3 cases both testicles seemed to be normal in size and consistency at the last examination, 1 year to 2 years and 4 months after operation. As yet in all these cases (adults) we have no data to assist us to determine whether the function of the testicle is or is not impaired.

Griffiths' experiments on dogs would lead one to believe that after the ligation of some of the vessels accompanying the *vas deferens* the function of the testicle may be destroyed in some cases without a macroscopic atrophy of the testicle. A summary of the results of Griffiths' experiments, published in the London *Lancet*, April, 1895, page 917, and in the *Journal of Anatomy and Physiology*, October, 1895, is as follows:

1. *Ligation of the vas deferens alone.*

- a. Does not produce atrophy of the testicle.
- b. Does not retard the development of the testicle in young dogs.
- c. Does not destroy the power of producing spermatozoa.

2. *Ligation of spermatic artery*; for a few days the testicle becomes swollen and there is degeneration of the epithelial cells which produce the spermatozoa; recovery usually follows. The degeneration, as a rule, affects only part of the testicle.

3. *Ligation of the veins alone.*

- a. Immediate swelling of the testicle, extravasation of blood and necrosis of the epithelium—usually followed by atrophy.

4. *Ligation of all the vascular constituents of the cord.*
  - a. Sloughing of the testicle.
  - b. Complete atrophy of the testicle.
  - c. Temporary fatty degeneration followed by recovery.

These observations of Griffiths on dogs and other animals correspond clinically very closely to the results recorded in this paper. In view of our own results and of Griffiths' experiments on animals, *one should not excise the veins on both sides either for varicocele or for hernia.*

Note, June 1, 1899. These two sections, Nos. XX and XXI, were completed about one year ago. Observations on both the recorded and recent cases have confirmed the conclusions with one exception. An atrophy of the testicle has been observed in one case in which, after an operation in which the veins were excised, no marked swelling of the testicle or induration of the epididymis was observed (Group I, Case No. 150; a colored child aged 3 years). The hernia was of the congenital variety. The patient was examined frequently after the operation, but not until one year did the atrophy of the testicle become evident, and it was not complete until two years after the operation.

In the 53 cases (page 346, paragraph 3) in which the veins have been excised after the method described in this article, atrophy of the testicle has not been observed. The majority of these cases have recently been examined.

In the 58 cases (page 347, paragraph 4) in which the veins were excised after the older method, one more case of atrophy has taken place (Group I, Case No. 150, already referred to).

The following recent cases have been observed:

Group	I.	Halsted's; veins excised	9 cases.
	I.	Halsted's; veins not excised	68
I (A).	Veins only transplanted	26	
	II. Cord not transplanted, veins not excised	14	
	II. Cord not transplanted, veins excised	7	
Varicocele—excision of veins in groin		20	

An atrophy of the testicle has not been observed in these 144 cases. In 36 cases the veins were excised.

These observations have demonstrated that the veins should not be excised in children; that when the veins are excised, the re-

remainder of the cord should be left undisturbed in the inguinal canal.

It is of the greatest importance in both the operations for hernia and varicocele to handle the cord as gently as possible. Extravasation of the blood and thrombosis in the veins frequently follow traumatism and may lead to epididymitis and atrophy.

If the veins are excised, either during the operation for hernia or for varicocele, no matter how carefully, a hydrocele may form after operation. This has been observed in from 10 to 15 per cent of the cases, and in about 5 per cent the hydrocele has given sufficient discomfort to demand operation. Atrophy of the testicle has not been observed in these cases.

In the 25 cases in which the cord has been split, transplanting the veins only, there has been no swelling of the testicle in 19 cases, and in 6 cases the swelling was slight and disappeared in a few days. In none of these 25 cases was thrombosis in the veins observed. In one recent case, a very difficult operation, the veins were injured. The epididymitis has been very marked.

In the operation for hernia or varicocele, in which a hydrocele is also present, the veins should not be excised and the sac of the hydrocele enucleated at the same time. Epididymitis and atrophy are very likely to follow or the hydrocele to return. The veins may be excised and the hydrocele operated on later. If the veins are not excised at the operation for hernia, epididymitis or atrophy has not been observed to follow the excision of the hydrocele.

Atrophy of the testicle has been observed in one case in which the normal testicle was replaced in the abdominal cavity (Group VIII, Case No. 2, an adult). The hernia returned, due to the descent of the testicle five months after operation. At the second operation (Group I, Case No. 237) the testicle was replaced in the scrotum. At that time the testicle was a little smaller than normal. Six months later distinct atrophy had taken place.

#### SEC. XXII.—OBSERVATION ON HYDROCELE FOLLOWING OPERATION FOR HERNIA.

##### *Acquired hernia.*

(1). Hydrocele has formed in 4 cases after the operation for acquired hernia in which the veins have not been excised.

Number of cases in which the veins have not been excised, 116.

Group	I.	Cord transplanted	100 cases.
	II.	Cord not transplanted	9
	III.	McBurney's operation	7

The great majority of these 116 cases have been examined. The 4 cases of hydrocele all occurred after Halsted's operation (Group I). In 1 case (No. 206) the hydrocele appeared within a few days after the operation. The operation in this case was for a recurrence along the cord after the Halsted operation. At the first operation the veins had not been excised; at the second operation the cord was surrounded by a good deal of new connective tissue and may have been subjected to more than the usual constriction by the retransplantation. Following the second operation no swelling of the testicle could be made out, except that due to the fluid in the tunica vaginalis. It was aspirated and contained about 30 cc. of clear fluid; it gave absolutely no discomfort. In the other 3 cases the hydroceles formed 2½ months, 5 months, and 6 years after operation; all are small and give no discomfort. In one of these cases the testicle after operation was not swollen (Class II). In 1 case there was slight epididymitis (Class III). In the third case there is no note on the condition of the testicle after operation (Cases Group I, Nos. 21, 186, 197 and 206).

(2). In the acquired hernia in which the *veins have been excised*, hydrocele has followed in 25 cases (22 per cent).

Number of cases veins excised, 112.

Group	I.	Cord transplanted	106 cases	22 hydroceles.
	II.	Cord not transplanted	5	1
	III.	Cord and veins excised	14	2

In 2 cases the hydrocele formed within a few days after operation. In 23 cases the hydrocele formed within a few months to 2 years after operation. In only 4 cases is the hydrocele of sufficient size to give any discomfort or to be detected by any but a practiced and expert observer. In 1 case it has been operated on. In the majority of these cases the patient is not aware of its existence, and only after the most careful examination has the presence of fluid in the tunica vaginalis been demonstrated.

It is interesting to note that in not one case of atrophy of the testicle which has followed the excision of the veins has a hydrocele

formed. In the majority of these 25 cases the immediate condition of the testicle after operation has been recorded either in Class II, no change, or in Class III, as very slight epididymitis.

The condition of the testicle immediately after operation in these 25 cases of hydrocele is as follows:

No epididymitis	5 cases.
Slight epididymitis	16
Marked epididymitis	4
Very marked epididymitis and abscess of scrotum	1

In this last case the testicle has not become atrophied.

These observations make another objection to the excision of the veins in the operation for hernia or varicocele (a hydrocele).

In one case there was present before the operation for hernia a small hydrocele; at the operation the veins were excised but the hydrocele was not disturbed; after the operation the hydrocele increased so much in size that the patient returned to the hospital for operation.

(3). Hydrocele has followed the excision of the veins for varicocele in 6 out of 45 cases (13 per cent) (see page 351).

#### *Congenital hernia.*

Hydrocele has followed the operation for congenital hernia only in those cases in which the remaining portion of the congenital sac was sutured over the testicle. Number of cases, 6.

In 5 cases the veins were excised; in 1 case the veins were not excised. In 2 of these 6 cases the hydrocele formed within a few days after operation; in 4 cases the hydrocele formed within 5 months to 1 year and 3 months after operation; in not one of these 6 cases is the hydrocele of sufficient size to give any discomfort.

In only one of the congenital herniæ in which a suture was made of the remaining portion of the congenital sac over the testicle, has a hydrocele *not* developed; in this case the veins were also excised; the testicle was normal at the last examination, 4 years after the operation.

In 11 cases of congenital hernia no suture was made of the remaining portion of the congenital sac. In 6 cases the veins were excised; in 5 cases the veins were not excised. In the 6 cases in which the veins were excised the testicle was normal at the last

examination, from 11 months to 3 years after operation. The 5 cases in which the veins were not excised are all recent cases, 1 to 3 months after operation. These observations clearly demonstrate that at the operation for congenital hernia the sac should be excised, but no suture should be made.

### SEC. XXIII.—OPERATIONS FOR HYDROCELE.

*Operations for hydrocele at the same time and through the same incision with the operation for hernia.*

Among 247 operations for inguinal hernia, hydrocele has been present in 11 cases, and 7 of these have been subjected to operation.

In 5 cases (Group I, Nos. 22, 59, 142 and 203, and Group V, No. 26) the small hydroceles were situated alongside the cord, between the sac and the testicle. The sacs were excised; none have recurred. (Hydrocele of the cord, males 4 cases, females 1 case.)

In one case (Group I, Case No. 36) the hydrocele was small and in the tunica vaginalis; it was simply incised and swabbed with pure carbolic acid. Immediately after operation a small haematoma formed, which was aspirated (10 cc. of blood-stained serum). Two years later the patient returned with a hydrocele 3 x 4 cm. in diameter. The sac was completely excised through an incision in the scrotum; the testicle and epididymis appeared normal (the veins had also been excised). Letter 6 months after operation for hydrocele, no recurrence. No swelling of the testicle followed the operation.

In one case (Group I, Case No. 158), at the operation for a large hernia, the veins were excised, and also the sac of a large hydrocele (7 x 6 cm.). Very little swelling of the testicle followed the operation. Examination September, 1897, 13 months after operation, no recurrence; perfect result.

These observations, although very few in number, are sufficient to demonstrate that hydroceles may be operated on at the same time and through the same incision with the operation for hernia, and that the best method is a complete excision of the sac, without suture and without swabbing with pure carbolic acid. This procedure is, however, *not recommended* in every case.

*Operations for hydrocele.*

In 3 cases the hydroceles were aspirated and injected with

carbolic acid; 2 cases have been lost sight of since operation. In the third case, patient writes (1 year 6 months since operation): "The hydrocele has returned and is as large as before operation."

In one case the hydrocele was incised and sac swabbed out with pure carbolic acid; wound closed with small gauze drain; the operation was done under cocaine. Following the operation there was slight swelling of testicle and epididymis. This patient has been examined (2 years and 10 months after operation) and result is a perfect one. The hydrocele was small, about 3 x 3 cm.

In 27 cases the sac of the hydrocele has been excised through an incision in the scrotum and the wound closed. In 7 cases the operation was performed under cocaine.

The immediate and ultimate results have been as follows:

Class 1. No note on the condition of the testicle immediately after operation. 12 cases. Ultimate results, lost track of 5 cases, perfect result 7 cases (examined 1 and heard from (by letter) 6).

Class 2. No swelling of testicle after operation. 4 cases. Perfect results, 3 cases (all examined). In one case the patient writes us that the hydrocele has returned. We have as yet been unable to confirm this by examination.<sup>1</sup>

Class 3. Very slight swelling of the testicle. 6 cases. Ultimate result, lost track of 2 cases, perfect result 4 cases (examined 2, heard from by letter 2).

Class 4. Marked epididymitis after operation. 1 case. This patient has been examined (2 years since operation) and testicle is smaller and appears to be atrophied.

Class 5. Very marked epididymitis with hæmatocoele after operation. 4 cases. Ultimate result, lost track of 2 cases; complete atrophy of the testicle, found by examination one year after operation, 1 case. In this patient the wound suppurred. The fourth case is a recent one, and swelling of the testicle has not yet disappeared.

The wounds have healed per primam in 25 cases. There has been suppuration of the wound in 2 cases. In 1 of these cases there was hæmatoma, and the testicle has atrophied; the second case, in which a gauze drain was also used, has been lost sight of.

In one case of large varicocele, the veins, as well as the sac, were excised.

<sup>1</sup> January, 1899. Examination. The hydrocele has not returned.

In 5 cases the wound in the scrotum was closed with a small gauze drain; one of these cases supplicated.

In 22 cases the wound was closed without drainage. In one case the wound supplicated, a large haematocele formed, there were secondary stitch abscesses, and the testicle has atrophied.

In 12 cases, after the excision of the sac of the hydrocele, the remaining portion of the tunica vaginalis was sutured over the testicle; 7 of these cases have been lost sight of and 5 cases are perfect results.

These observations demonstrate that if very marked swelling of the testicle and the epididymis, or the formation of a haematocele follows operation, atrophy of the testicle may take place, as shown by the figures in Class 4 and 5. 5 cases with two atrophies; 2 cases lost sight of, and one recent. However, in these 2 cases, in which the testicle was found to be atrophied at a subsequent examination, there is no note at the time of the operation as to the size of the testicle. Atrophy of the testicle has been found to be present at the operation for hydrocele in one of these 27 cases.

These observations show at least that in 5 of the 12 cases in which the tunica vaginalis has been sutured over the testicle after the excision of the sac such a procedure is not followed by the reformation of a hydrocele. How different from our observations on congenital hernia, where a hydrocele has almost invariably followed the suture of the remaining portion of the tunica vaginalis over the testicle!

Excision of the sac of the hydrocele through an incision in the groin similar to that made for hernia. 9 cases.

The immediate results have been as follows:

Class 2. No swelling of the testicle, 2 cases. Ultimate result, 1 case perfect result (2 years examination). In this case a hernia operation was performed at the same time through the same incision; the second case is a recent one.

Class 3. Very slight swelling, 3 cases. Ultimate results, lost track of 1 case, perfect result 2 cases (heard from by letter). In 1 of these cases the veins of a large varicocele on the same side were ligated and excised through the same incision. This patient writes (1 year and 6 months after operation) that the testicle is normal in size and that he is perfectly well.

Class 4. Marked swelling of the testicle and epididymis after

operation, 3 cases; lost track of 1 case, perfect result 1 case (examined 8 months after operation); the third case is a recent one.

Class 5. Hæmatocoele following operation, 2 cases. In 1 case the hydrocele was very large and the testicle was also enlarged. As the induration of the testicle and epididymis did not disappear, six months after operation the patient submitted to castration by some other surgeon. The second case is a recent one.

In every one of these 9 cases the wounds have healed absolutely per primam, and there have been no secondary stitch abscesses; atrophy of the testicle or the recurrence of the hydrocele has not taken place in any case.

The number of operations in which the sac of the hydrocele has been excised through an incision in the groin is not yet sufficient to demonstrate that this method has any advantages over the operation in which the incision is made in the scrotum, except that the healing of the wound has been perfect.

The chief danger in all operations for hydrocele in which the sac is excised is hemorrhage from the vessels which have been divided in excising the sac. This danger is just as great whether the incision is made in the groin or in the scrotum. When the operation is done through an incision in the groin the testicle is subjected to more manipulation than when the operation is performed through an incision in the scrotum.

Our observations do not demonstrate any objection to suture of the remaining portion of the tunica vaginalis in 8 cases of hydrocele, but there seems to be no good reason why this should be done.

In view of the danger of epididymitis and the probability of atrophy of the testicle after excision of the veins, it certainly adds to the risk of atrophy to perform the operation for varicocele and hydrocele at the same time and on the same side, although in the 2 cases in which this has been done atrophy has not followed.

In a small hydrocele the sac can be excised without pain and with great ease by an incision through the scrotum under cocaine anæsthesia.

The most difficult cases are very large hydroceles in which the sac wall is thick and vascular; it has only been in these cases that very marked epididymitis or hæmatocoele has followed operation; and in 2 cases atrophy.

Although we have had no bad results in the few cases in which a hydrocele has been excised at the same time that a hernia has

been operated on, yet the writer is of the opinion that, except in a few cases of small herniæ, it adds to the risk of epididymitis, and subsequent atrophy of the testicle, to excise the sac of the hydrocele (especially if it is a large one) at the same time that the operation for hernia is performed. If the sac of the hydrocele is excised when the hernia is operated upon, it is especially contra-indicated to excise the veins, although in the one case in which the writer did this there has been no bad result.

In a recent case (Group I, No. 222) at the operation for a hernia of medium size, the varicose veins were ligated and excised, and the sac of a large hydrocele excised through the same incision. A very large haematocele formed at once, and two months later the patient returned for a second operation on the hydrocele.

SEC. XXIV.—**CASTRATION THROUGH AN INCISION IN THE GROIN,  
SIMILAR TO THE INCISION FOR THE HERNIA AND  
VARICOCELE OPERATIONS.**

Our hernia operations soon taught us that the testicles might readily be removed through an incision in the groin. This procedure allows higher ligation of the vas deferens and its vessels; in every case the wounds have healed *per primam* throughout. The higher the incision the more easily is it covered by a dressing; catheterization and urination are performed with less difficulty when the testicle has been removed by an incision through the groin. In not one case has the scrotum become distended with blood or fluid.

SEC. XXV.—**UMBILICAL AND OTHER VENTRAL HERNIA.**

These cases, which make up Group IX, may be summarized as follows (two are also included in Groups XI and XIII):

1. Umbilical hernia	13 cases.
2. Properitoneal ventral hernia	3
3. Hernia in the right linea semilunaris	1
4. Hernia following operation for appendicitis	2
5. Hernia following incision in the groin for drainage of the space of Retzius in cases of rupture of the urinary bladder	3
6. Hernia following rupture of the abdominal muscles	1
	<hr/>
	23

Death occurred in 3 cases; recurrences in 3 cases.

*Death.*—(1). Group XIII, Case 1. Colored child; æt. 5 years. Tubercular peritonitis. General septic peritonitis following resection and suture. Hernia irreducible.

(2). Group XI, Case 9. General peritonitis. Hernia had been strangulated six days and peritonitis was present at the operation.

(3). Group X, No. 20. Strangulated hernia; death from pneumonia on the third day.

In the 20 cases which recovered the wound healed p. p. in 18 days; 1 case supplicated (Case 9); stitch abscess and sinuses from silver-wire sutures. In Case 19 the wound was partly packed with gauze.

Suture material: silk, 7 cases; silver wire, 13 cases.

*Recurrences.*—(Group IX, Cases 1, 3, 4.) In Case 1 the hernia was very small. The umbilicus was not excised; the fascia only was sutured with silk. The recurrence took place in one year, and up to September, 1897, it had not increased in size, 4 years after operation. In this case no attempt was made to expose the recti muscles because at this time we had experienced no recurrences in herniæ of the linea alba, and hence it had not occurred to Dr. Halsted to use the recti muscles to line these wounds.

In Case 4 the hernia was small and situated between the ensiform and umbilicus. In this case, also, and for the same reason, the fascia only was sutured. Recurrence took place in 1 year.

In Case 3 the hernia was large. The umbilicus was excised; the fascia only was sutured, with silk. The recti muscles were situated too far apart to be included in the sutures. The patient wrote, November, 1894, 8 months after operation, that there was a bulging in the scar. She has not been heard from since.

In Case 19, on account of the critical condition of the patient and the retraction of the ruptured muscles, it was impossible to perform a radical operation. The patient wears an abdominal support.

*The importance of including muscle surfaces in the sutures is shown by the following cases:*

In 4 cases (Nos. 1, 2, 4 and 12) no attempt was made to expose the recti muscles and include them in the sutures. Cases Nos. 1 and 4 have recurred. Case No. 2 is well (examination 3 years and

8 months after operation). The hernia was very small; the patient was a boy aet. 21 months. Case No. 12 is a recent one (examination August, 1897, after 3 months, perfect result). The hernia was situated in the middle line between the ensiform and umbilicus, as in Case 4.

In 5 cases (Nos. 3, 6, 7, 8 and 10) the recti muscles were too widely separated to be included in the sutures. Case 3 has recurred. Case 6 has been lost sight of. Cases 7, 8 and 10 are perfect results, 1 year and 6 months, 1 year and 2 months, and 5 months respectively after operation. In Case No. 10 two rows of sutures were employed (see history).

In 3 cases (Nos. 5, 9 and 11) the recti muscles were exposed and included in the sutures. All are perfect results 3 years and 4 months, 1 year and 8 months, and 2 months since operation.

In the following 6 cases of ventral herniæ raw muscle surfaces as well as fascia were approximated, and the ultimate result in every case was a perfect one. In Case 13 the hernia protruded through the right linea semilunaris. In this case not only was the internal oblique muscle divided, but also the sheath of the rectus, so that in closing the wound *the rectus muscle* was approximated to the divided internal oblique muscle. In Cases 14 and 15 the operation was done for small herniæ which had occurred through the scar tissue left by the gauze drain after an operation for acute appendicitis; the drain was used for an abscess cavity. In these two cases the scar tissue was completely excised over the entire length of the old laparotomy wound, and fresh-cut surfaces of the abdominal muscles were made and approximated by suture. In Cases 16, 17 and 18 the herniæ had taken place through scars resulting from incisions made in the groin to drain the space of Retzius in cases of rupture of the bladder with extravasation. In these 3 cases also the scar tissue was completely excised and fresh-cut surfaces of muscle were approximated. The wounds in all these 5 cases healed per primam; and every case at the present writing (December, 1897) shows a perfect result, the time since the operation varying from 8 months to 2 years and 3 months.

Thus in 9 cases in which the muscles were included in the sutures not a single recurrence has taken place; in the 9 cases in which the muscles were not included there was a recurrence in 3; one case has been lost sight of.

The results in these cases of ventral hernia demonstrate clearly the importance of including the raw muscle surfaces in laparotomy wounds, for example in cases of umbilical hernia, of exposing the recti muscles and including them with fascia in the sutures.

In the operation for umbilical hernia our experience teaches us that one should always excise the umbilicus. The writer has found that it is very convenient to open into the abdominal cavity to the right of the umbilicus. If the sac is found to contain adherent omentum it can be ligated through this opening. The sac with its adherent omentum is then turned towards the left and removed in one piece with a small area of skin.

Note, August, 1898. The last case, No. 21, a very large strangulated hernia in a very fat woman, was operated on under cocaine and a few whiffs of chloroform; the wound healed per primam. June, 1899. Examination; the result is a perfect one.

June, 1899. No further recurrences have been observed in this group.

#### SEC. XXVI.—FEMORAL HERNIA.

Group X comprises 31 cases of femoral hernia; 17 were strangulated. There were 6 deaths; in all these cases the hernia was strangulated. In one (Group V, Case 9) the contents of the sac consisted of omentum in good condition; death took place on the 10th day from acute infection, a right-sided hydronephrosis. The autopsy showed no infection of the wound or peritoneum.

In 5 cases death was due to gangrene of the intestines or peritonitis present at the time of operation (see Group XI, Cases 4, 5, 6, 7 and 8).

The ultimate results in the 25 cases of femoral hernia which lived may be summarized as follows: Lost trace of since operation, 2 cases; recent cases not heard from, 2 cases; perfect results, 15 cases (examined by writer, 14 cases; letter, 1 case).

7 to 8 years, 1 case; 4 to 5 years, 1 case; 3 to 4 years, 2 cases; 1 to 2 years, 6 cases;  $\frac{1}{2}$  to 1 year, 5 cases.

Healing of the wounds. In every case the wounds have healed absolutely per primam and no secondary stitch abscesses have followed.

In every case the convalescence has been uneventful and no complications have followed operation.

*Modes of Operating for the Cure of Femoral Hernia.*

In 7 cases the sac was completely excised and sutured as high as possible and the skin incision closed after introducing a small piece of gauze down to the stump of the sutured sac, so that a cone-shaped cavity was made, which healed by granulation. The apex of the cone is situated at the site of the stump of the sutured sac (the method usually pursued by Dr. Halsted).

In 15 cases the sac was excised and closed, after which an attempt was made to approximate all the available fascia by sutures over the femoral opening; the sutures also included Poupart's ligament; the skin wound was then completely closed (Finney and Bloodgood).

In one case Dr. Finney transplanted the rectus muscle and closed the wound.

In 2 cases Dr. Finney performed a plastic operation on the adductor muscle and closed the wound. This method he is about to publish.

The ultimate results are equally perfect in all cases, demonstrating (at least so far as our observations go) that the cure of the femoral hernia is not a difficult problem, and that it is not necessary to perform any complicated operation upon the fascia or muscle about the canal in order to get tissue to suture over the femoral opening. At the autopsy in Case No. 9, in which death took place on the 10th day and in which the wound had been completely closed, the writer excised the scar and demonstrated macroscopically a solid wall of tissue about 3 cm. in thickness between the skin and the peritoneum.

The writer is of opinion that if, because of a very large femoral opening, it should appear necessary to perform some plastic operation in order to get tissue to cover the opening, it might be better to divide the aponeurosis of the external oblique from the position of the external ring upwards, then ligate and divide the deep epigastric vessels, and cover the femoral opening on the inner side by transplanting the rectus muscle. This has been done in one case by Dr. Finney.

Our experience with femoral hernia has been chiefly with strangled cases, and in these it is very important that the sac should be opened at once before it is separated and before the constriction

is divided. If the constriction is first divided, the contents of the sac are very apt to become reduced, so that when the sac is opened the operator will be unable to ascertain the state of the intestine or omentum without performing a laparotomy. The following method for dissection of the sac in femoral hernia we have found a very rapid and convenient one:

(1). The skin incision is nearly semilunar in shape, below Poupart's ligament (convexity below). If necessary to enlarge downwards, a straight incision is made, tangential to the first. The skin flap is dissected upwards until Poupart's ligament is fully exposed.

(2). The sac is then opened, the direction of the incision being in the long axis of the limb, and the contents reduced; the sac is then divided across about 2 to 3 cm. from its neck; the upper portion is separated from the surrounding tissue and divided by scissors into two flaps, which are then caught with four artery clamps and drawn outwards. The opening into the peritoneal cavity is sutured with silk and the excess of tissue excised, allowing the closed stump to retract into the abdominal cavity. The remainder of the sac is caught with artery clamps and with two or more fingers of the left hand introduced into its lumen, the sac is rapidly dissected out or torn from above downwards. We have found that this method is not only very simple, but also rapid; furthermore, it avoids the cutting of many of the numerous vessels in the fasciæ about the sac, and also preserves the fasciæ in better condition for suture; again, in many cases of femoral hernia, below and above the sac, masses of vascular properitoneal fat are encountered, which would require many ligatures and render the dissection tedious, if it is made from below upwards; whereas when the dissection is made as described—from above downwards—the sac is easily peeled out of this vascular tissue, which is left in place.

(3). After the removal of the sac the different layers of fascia which formed its covering are approximated by sutures to Poupart's ligament, so that in the majority of cases this tissue fills the cavity in front of the femoral opening.

(4). The skin incision is closed by suture; the wound is dressed with a large mass of gauze, which is so fixed with plaster bandages that the tissues are firmly compressed against the femoral canal.

(5). In strangulated hernia the method is similar. In cases in which the constriction prevents reduction of the contents of the sac,

the tissues between Poupart's ligament and the peritoneum are first divided. The section is made between two artery clamps, so that vessels which might retract are caught before they are divided. The clamps are also useful as retractors. If the division of the tissues does not render the reduction possible, Poupart's ligament is divided until sufficient room is made to allow of reduction with ease. In closing the wound after the suture of the sac in such cases, the divided Poupart's ligament is sutured.

(6). If the sac contains adherent omentum, the omental vessels are ligated at once near the neck, and the remainder is removed in one piece with the sac. If the sac contains a mass of irreducible omentum, it is better and quicker in most cases to draw out the omentum, ligate the neck and excise, rather than enlarge the femoral opening and reduce.

June, 1899. No recurrences have been observed.

#### APPENDIX.

##### PUBLICATIONS, ETC.

(I). The first publication by Dr. Halsted on "The Radical Cure of Hernia." [The Johns Hopkins Hospital Bulletin, vol. i, No. 1, December, 1899.]

Dr. Wm. S. Halsted presented five patients upon whom he had performed his operation for the cure of inguinal hernia. He described the operation as follows:

"1st. The incision begins at the external abdominal ring and ends one inch or less (less than one inch in children) to the inner side of the anterior superior spine of the ilium on an imaginary line connecting the anterior superior spines of the ilia. Throughout the entire length of the incision everything superficial to the peritoneum is cut through.

"2nd. The vas deferens, with its vessels, is carefully isolated up to the outer termination of the incision and held aside.

"3rd. The sac is opened and dissected from the tissues which envelop it.

"4th. The abdominal cavity is closed by mattress sutures passed through the peritoneum at a level higher by  $1\frac{1}{2}$ -2 inches than that of the so-called neck of the sac.

"5th. The vas deferens and its vessels are transplanted to the upper outer angle of the wound.

“6th. Interrupted, strong silk sutures, passed so as to include everything between the skin and the peritoneum, are used to close the deeper portion of the wound, which is sewed from the crest of the pubes to the upper outer angle of the incision. The cord now lies superficial to these sutures, and emerges through the abdominal muscles about one inch to the inner side of the anterior superior spine of the ilium.

“7th. The skin is united over the cord by interrupted stitches of very fine silk. These stitches do not perforate the skin, and when tied they become buried. They are taken from the under side of the skin and made to include only its deep layers—the layers which are not occupied by sebaceous follicles.”

Dr. Halsted has for ten years closed his wounds in this way. The method was suggested to him by his experiments on dogs. He found that it was impossible to disinfect the skin of a dog, and believes that pyogenic organisms are frequently present in the sebaceous follicles of the skin. He had repeatedly observed pus in the suture holes of the perforating skin stitches, and could not with any certainty secure primary union of the skin wounds of dogs until he had resorted to this subcutaneous method of sewing the skin.

Dr. Halsted remarked in this connection that whether or not it were possible or easy to disinfect absolutely the human skin, he had been much impressed with the fact that skin sutures sooner or later suppurate, even in wounds sewed by the most careful surgeons in this country and abroad. He thought it advisable, therefore, to test for a time the subcutaneous, buried skin suture.

“8th. One or two small, short gauze plugs are used as wound drains.

“*The after-treatment.*—The gauze plugs are removed at the first dressing, usually at about the seventh day. The patients are allowed to walk about on the 21st day.”

II. Excision of some of the Veins of the Cord in the Operation for the Radical Cure of Inguinal Hernia.—Dr. Halsted.  
[The Johns Hopkins Bulletin, vol. iii, No. 23, June, 1892.]

Dr. Halsted presented several cases to illustrate a modification of his operation for the cure of hernia. The bundle of veins which accompanies the vas deferens is often as large as one's finger. He

believes that some or most of these veins may be superfluous, and, accordingly, excises all but one or two of them. By this procedure the cord may often be reduced to less than one-fourth of its original size. It is reasonable to suppose that the size of the cord may influence the tendency of the hernia to return.

III. The Radical Cure of Inguinal Hernia in the Male. The Johns Hopkins Bulletin, vol. iv, No. 29, March, 1893. This is Doctor Halsted's principal article. 82 cases are reported.

IV. Report of Twelve Cases of Complete Radical Cure of Hernia, by Halsted's Method, of over Two Years' Standing; Silver-Wire Sutures.—Dr. Halsted. The Johns Hopkins Bulletin, vol. v, No. 42, October, 1894.

“Dr. Bloodgood has very kindly written to all of the old hernia cases in town and to several living out of town, requesting them to come to show themselves to-night. It is now nearly five years that we have done this operation for the radical cure of hernia. You may remember that little more than a year ago we reported 89 cases of hernia, and that there were no recurrences in the cases of union by first intention. In 6 cases there was more or less of a recurrence, but all of these cases had supplicated for some reason or other, and had healed by granulation. It remains to be seen whether or not there are any returns amongst the cases here to-night.

“This first man was operated upon only two weeks ago to-day. In this case and other recent cases we have used silver sutures instead of silk, not because we wish anything stronger than silk, but because of the results of experiments which Dr. Bolton has kindly made for us, and which we have made, to determine the power of different metals to inhibit the growth of bacteria. This line of experimentation is not entirely original with us. Dr. Bolton has found that zinc and cadmium and copper were perhaps the best metals to inhibit the growth of organisms. Silver is perhaps the next best metal, and we are using, therefore, silver wire altogether, both for deep-buried sutures and for the continuous buried skin sutures. This is a beautiful instance of healing by first intention.

“Since my last report of a year ago we have had a great many cases of hernia, and so far there have been, we believe, no recurrences.”

V. The Operative Treatment of Hernia.—Dr. Halsted. [Extracted from The American Journal of the Medical Sciences, July, 1895.]

“The problem is to close durably a rent in the abdominal wall and to provide for the safe transmission of the spermatic cord. The cord is the first cause of the hernia and the ultimate obstacle to its cure. If we could ignore the cord, the solution of the problem would be comparatively easy. The larger the cord the greater the liability to a recurrence of the hernia. The size of the cord depends chiefly upon the veins. Then why not reduce the size of the cord by excising such veins as may be superfluous? By this procedure the cord may usually be reduced to less than one-third, and sometimes to one-fifth or one-sixth of its original size. Two quite distinct sets of veins accompany the *vas deferens*. When the tunica vaginalis propria funiculi spermatici has been divided and the elements of the cord are gently spread out by the fingers, the larger superfluous bundle of veins lies at some distance from the *vas deferens*. A few very delicate veins hug the *vas deferens* closely. The veins which we designate as ‘superfluous’ are those which I regularly excise in operations for varicocele. We have not thus far seen atrophy<sup>1</sup> of the testicle follow excision of these veins. Our cases have been observed with especial reference to this point. I think that there can be little doubt as to the advisability of reducing the size of the cord by excising these veins when they form a large bundle.

“Let us consider next the closing of the hole in the abdominal wall. What tissue shall we employ and how shall we bring these tissues together? It has been demonstrated too often that the stitching of the pillars of the ring does not suffice. We must do more than bring free edges of the aponeurosis of the external oblique muscle together. Fortunately we have muscles so near at hand and so placed as to suggest at once a simple, and what has proved to be an entirely effective, plastic operation. After cutting through the anterior wall of the canal down to the sac, we continue the incision in the same line, outward and a little upward, through

<sup>1</sup> May 15, 1895. In three of our cases atrophy of the testicle has been caused by the operation. The atrophy is probably due to the excision of the veins, for it has occurred thus far only in the cases in which the veins were excised.—W. S. HALSTED.

the internal oblique and transversalis muscles for an inch or less. We divide the muscle bundles about at right angles to their long axes. Thus two flaps of muscle are obtained, which we draw down into the canal and include in the deep stitches in the way to be described. The uppermost bundles of the cremaster muscle are often so heavy that we can use them for the same purpose. We close the opening which Nature has made and which the knife has enlarged with mattress sutures, precisely as we close all abdominal wounds. The mattress suture is to be preferred to other sutures because it constricts the tissues less, holds greater surfaces in contact, and insures, ultimately, more accurate apposition of the several planes of tissue. These stitches bring surfaces together at the outset, just as in sutures of the intestines the walls of the intestine, irrespective of the stitch, are always brought together. The walls of the intestine are so inverted that the muscular surfaces (so-called peritoneal surfaces) are extensively in contact, the cut edges never. And yet after a few weeks no trace of the inversion remains. Sometimes an almost imperceptible dark line is left to indicate the position of the cicatrix. With the aid of the microscope we see that the finest layer has met its fellow and may be traced uninterruptedly through the cicatrix, and were it not for the rudimentary character of a few of the villi, we might search in vain for evidence of the solution in continuity.

“Dr. Mall,<sup>1</sup> for whom I performed some experiments which necessitated circular suture of the intestine, describes the microscopical appearance of an intestinal suture of sixty-four days as follows: ‘Fig. 12 shows a section of this suture which strikes the stitches. Were it not for this stitch and a slight infiltration of that part with leucocytes, the point of suture could not be made out. To be sure, the microscope shows very rudimentary villi which could easily be overlooked when compared with the other folds which this intestine contains. The crypts are fully regenerated and cannot be differentiated from the surrounding crypts. The stratum fibrosum, muscularis mucosæ, submucosa, and two muscular coats are all reproduced and form one straight line. The regeneration is so complete that the two layers of the regenerated muscularis mucosæ can be made out.’

<sup>1</sup> Johns Hopkins Hospital Reports, vol. i, p. 90.

"There are usually six of these deep stitches. They are taken very close together, not more than 1 cm. apart. The two arms of each stitch are 7 or 8 mm. apart. The vas deferens, with its arteries and remaining veins, is brought forward between the two outermost stitches. These two stitches are closer together than the others and embrace the cord snugly. The outer arm of the outermost stitch is sometimes passed through uncut muscle.

"When the deep wound is closed muscle should be seen throughout the greater part of it, projecting between the cut edges of the aponeurosis of the external oblique muscle. These edges are then made to embrace the cord more snugly at the point where it passes between them by two very fine stitches. The skin incision is closed with an uninterrupted suture. As we approach, in stitching, the lower inner angle of the deep wound the muscle becomes thinner and finally gives out. The aponeurosis of the external oblique, with perhaps a few fibres of the cremaster, is all that is left for the innermost stitch. If the aponeurosis at this point shows, as it sometimes does, a tendency to split when it is vigorously pulled upon by a stitch, we gather or pucker it up by taking running mattress sutures in place of the ordinary mattress sutures. In running the stitches I try to avoid perforating the aponeurosis. The puckering is, of course, only a temporary affair, but the running stitches enable us to close the lower angle of the deep wound with less damage to the aponeurosis.

"In short, we close our hernia wounds precisely as we close all wounds of the abdomen, except that in hernia alone we stitch the peritoneum separately. In wounds of the linea alba we split the sheaths of the recti muscles, whether we are operating for the cure of hernia or not, that we may oppose broad surfaces of muscle throughout the whole length of the incision.<sup>1</sup> For the same reason, and also that we may transplant the cord in the male and the round ligament in the female, we divide the internal oblique and transversalis muscles when operating for the cure of inguinal hernia.

"I shall say but a few words at this time about our results, for Dr. Bloodgood will soon publish a complete report of them.

<sup>1</sup> In a recent number of the *Centralblatt für Chirurgie*, P. Bruns, of Tübingen, describes and recommends a method for the cure of ruptures in the linea alba which, except that he does not employ the mattress sutures, is identically ours for closing all incisions in the linea alba.

"We have operated one hundred and sixty times for the cure of various forms of hernia in both sexes without a death from the operation. One hundred and six males with inguinal hernia have been operated upon by my method. The wounds, with few exceptions, have healed absolutely per primam. Thus far we have been unable to find a single recurrence in cases whose wounds healed per primam. The case which furnishes the nearest approach to a recurrence was operated upon about three years ago and is now under daily observation. The man has the physiognomy of a Hindoo, but is classed as a negro. He is about thirty-five years old, not much more than half-witted, and was on admission, and still is, much emaciated and exceedingly feeble. Within the first twenty-four hours he got out of bed. Possibly he repeated this act of disobedience daily. The wound healed absolutely per primam. There is at present, but only on coughing, a bulging of the very thin, flabby abdominal wall from the inner almost to the outer end of the scar. The local condition is not bad enough to demand a second operation."

I dislike to have my operation referred to as a modification of Bassini's operation. The operations are undoubtedly original with both of us, and mine was described several months before we had heard of Bassini's operation. You may know that in my operation the cord which is transplanted out into the thicker muscle lies superficial to the aponeurosis of the external oblique muscle, and not, as in Bassini's operation, in a fold of and under this aponeurosis. In Bassini's operation the circulation of the aponeurosis must be impaired, both by the foldings of the aponeurosis near Poupart's ligament and by the stitches which temporarily maintain them. Furthermore, Bassini's method does not, as he claims, re-establish the obliquity of the canal. Bassini believes that he restores the inguinal canal to its physiological condition when he makes "a canal with two openings, an abdominal and a subcutaneous opening, and with two walls, a posterior and an anterior, through the middle of which the cord passes obliquely." But the original canal is not by any means an affair so simple as Bassini's. To reproduce the equivalent, anatomically and physiologically, of the inguinal canal is for us impossible.

For about one year I have sewed all of my hernia wounds with silver wire and have covered them with silver foil. Without exception the wounds have healed absolutely per primam. Not a

single stitch abscess has been observed either during or subsequent to the healing of the wound. Such absolutely perfect healing of the hernia wounds we have not had heretofore, and I am convinced that the use of silver as a suture material has contributed somewhat to this result. We have tested the effect of silver on the growth of the more common pyogenic organisms. I have here two Pétri plates which Dr. Bolton has kindly prepared for me. They have both been inoculated with *staphylococcus pyogenes aureus*. In the centre of each plate is a piece of silver foil, such as we use on our wounds. Just outside, and completely surrounding the foil, is a perfectly clear zone several millimetres wide. Except for the clear zone and a slightly intensified zone just outside of this, the agar is quite uniformly cloudy. The cloudiness is due to the growth of the micro-organisms with which the agar has been inoculated. Dr. Bolton has studied the effects of various metals on the growth of bacteria, and has recently read a most interesting paper on this subject before the Association of American Physicians. With cadmium, zinc, and copper, Dr. Bolton observed that the inhibitory action was greater than with silver. Prior to my knowledge of Dr. Bolton's experiments I tried to use copper and brass foil for protective, and copper and brass wire for sutures; but these metals corroded the tissues so much that I soon stopped using them. We do not hesitate to employ buried sutures of silver wire in sewing tissues on the confines of an infected region. In cases of acute suppurative appendicitis, for example, we close the wound in the abdominal wall with deep, interrupted, buried sutures.<sup>1</sup> These wounds are drained by a few strips of gauze. Two of the sutures are taken very close to this gauze, and sometimes must pass through tissues which are infected. Not even in such cases have we ever had a stitch abscess. Once a silver stitch and once a silver bone plate, having been exposed to view and to the air by necrosis of the overlying tissues, were allowed to remain and to become imbedded in the granulations of the wound, which healed by suppuration. Neither the stitch nor the plate at any time caused the slightest disturbance in the tissues or inconvenience to the patient.

We have already observed much in the use of silver wire that is worth recording and enough to satisfy us that it will play a new and more important rôle in the surgery of the near future.

<sup>1</sup> Vide Bulletin of the Johns Hopkins Hospital, November, 1894.

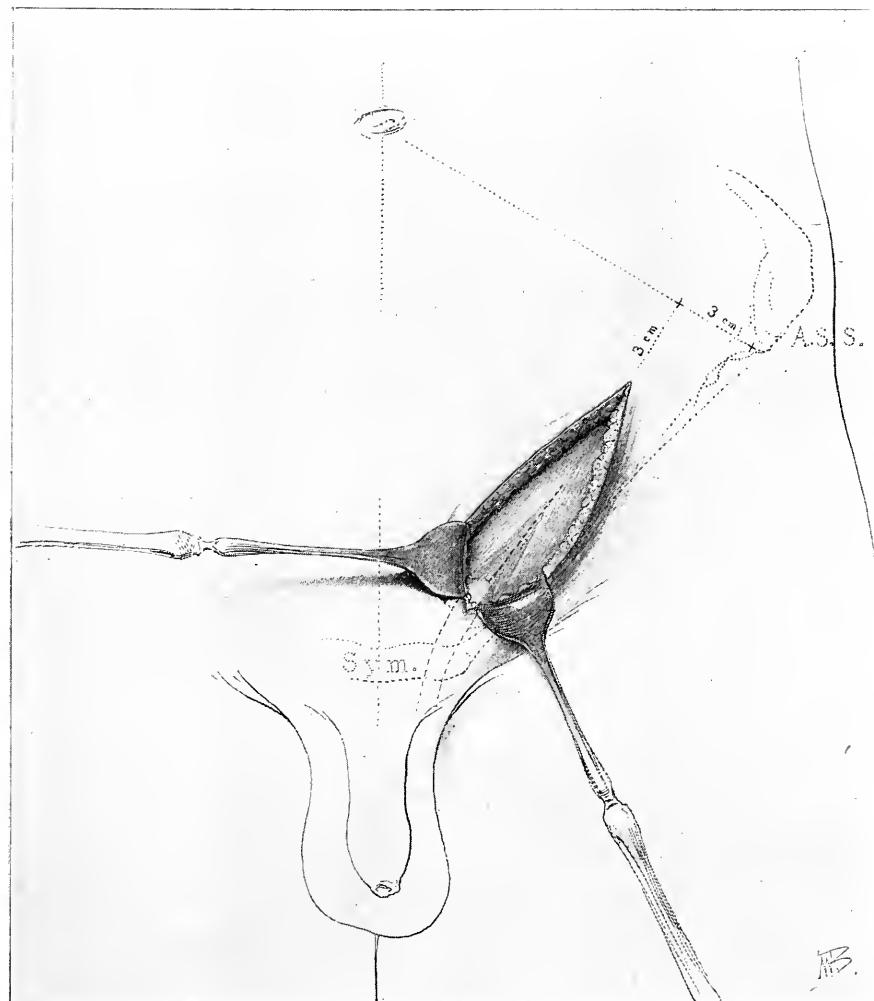


FIG. 1. The skin incision, retractors in the lower angle of the wound dislocating the opening in the skin and subcutaneous fat downwards, exposing the aponeurosis of the external oblique and external ring. The dotted line represents the direction of the division of aponeurosis of external oblique.



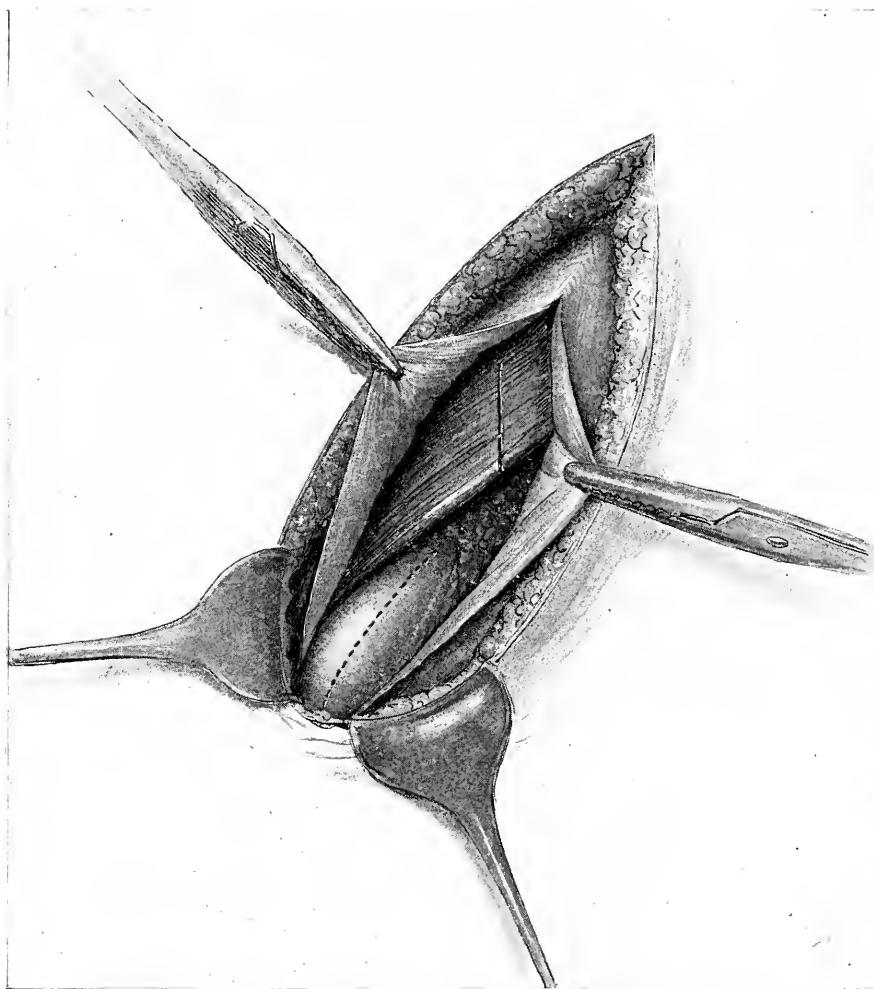


FIG. 2. The aponeurosis of external oblique has been divided and retracted, uncovering the internal oblique muscle and inguinal canal. The lines on the muscle represent the direction and extent of the division. The dotted line in the inguinal canal is the direction and extent of the division of the coverings of sac.



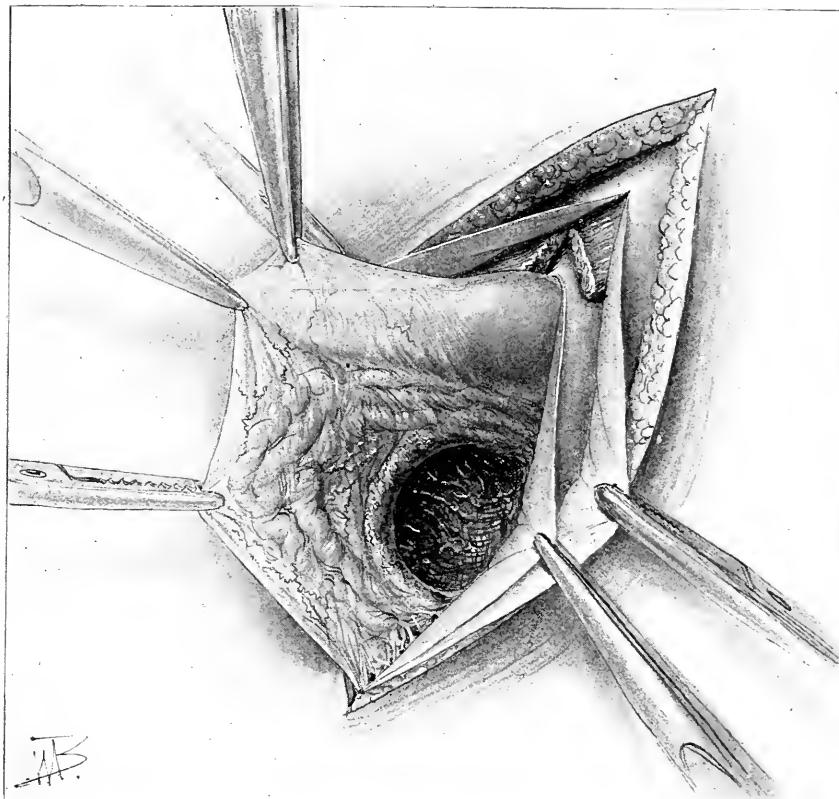


FIG. 3. The internal oblique muscle and the coverings of the sac have been divided, the sac with the veins and vas deferens are drawn out of the wound preparatory to the excision of the sac and the ligation and excision of the veins.



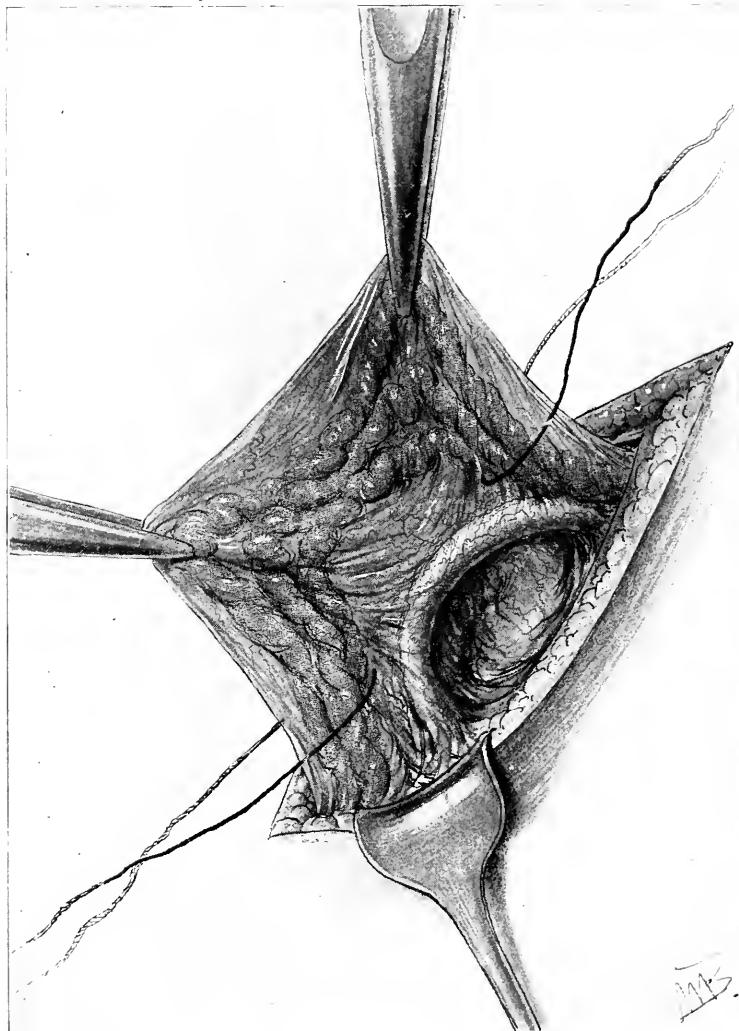


FIG. 3a. The method of excision of veins in operations for hernia and varicocele. The vas deferens and its "immediate" vessels and the mesocord have not been disturbed.



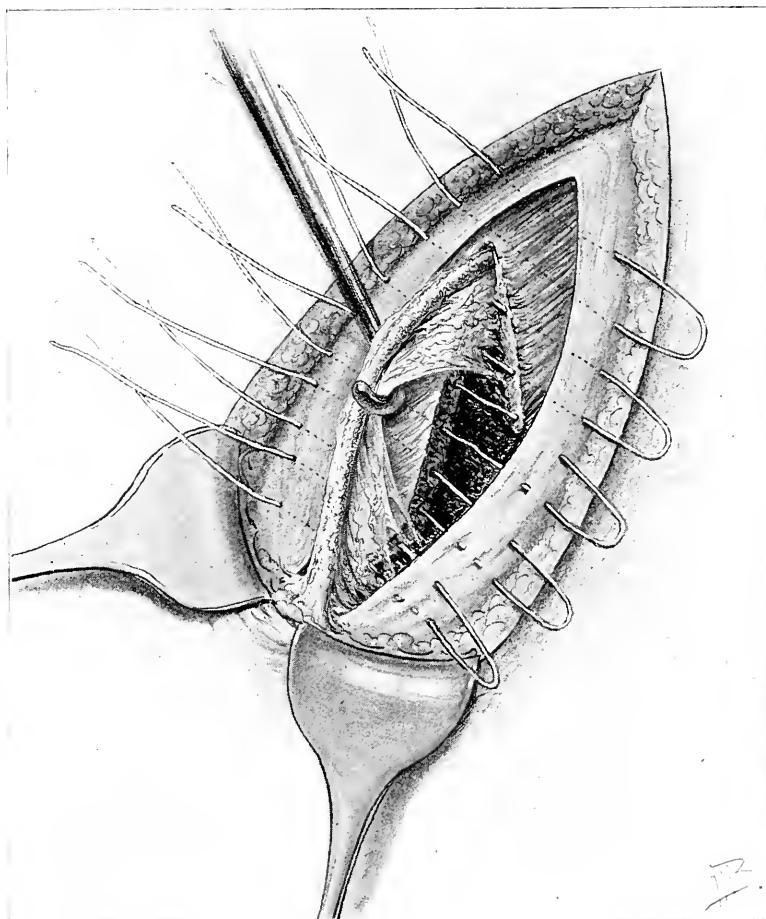


FIG. 4. The insertion of the deep silver wire sutures, one above and four below the cord. The veins have been ligated and excised. The mesocord has been torn gently in its center only.



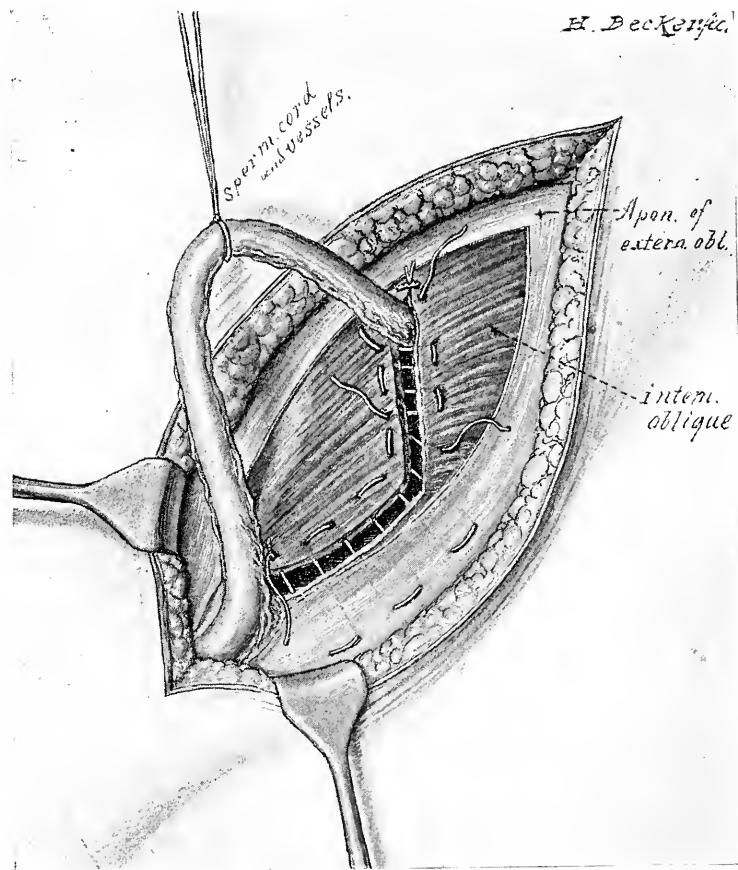


FIG. 5. The writer's method of more perfectly approximating the divided and transplanted internal oblique muscle, either preliminary to or after the insertion of the deep sutures of silver wire. This drawing shows that the divided and transplanted internal oblique muscle lines only the upper two-thirds of the wound; if the lower third is not protected by a wide and strong conjoined tendon, the rectus muscle should be transplanted (see Figs. 9 and 10).



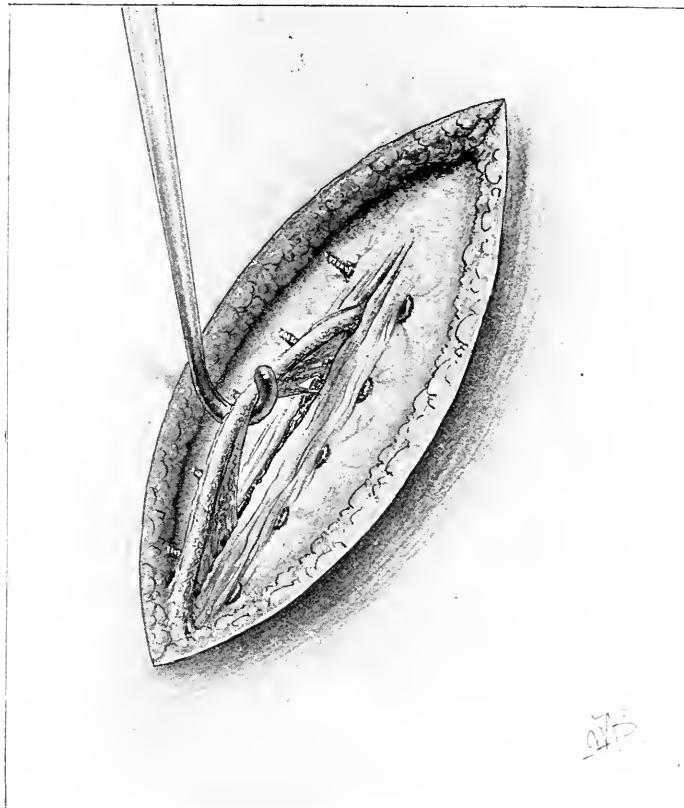


FIG. 6. The deep sutures of silver wire drawn home, twisted and cut. The ends have not yet been bent over.



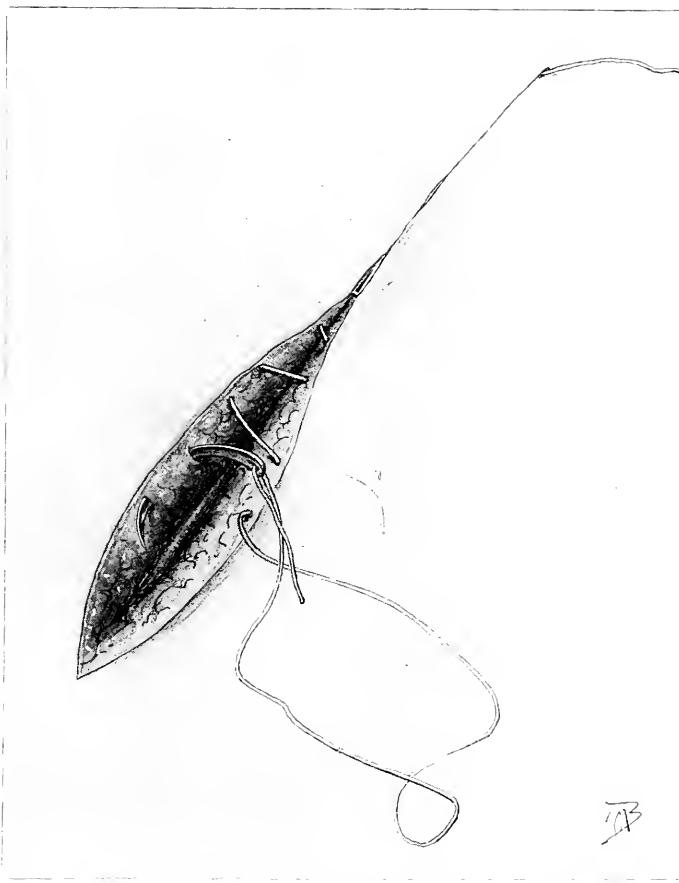


FIG. 7. The method of introducing the continuous subcutaneous suture of silver wire.



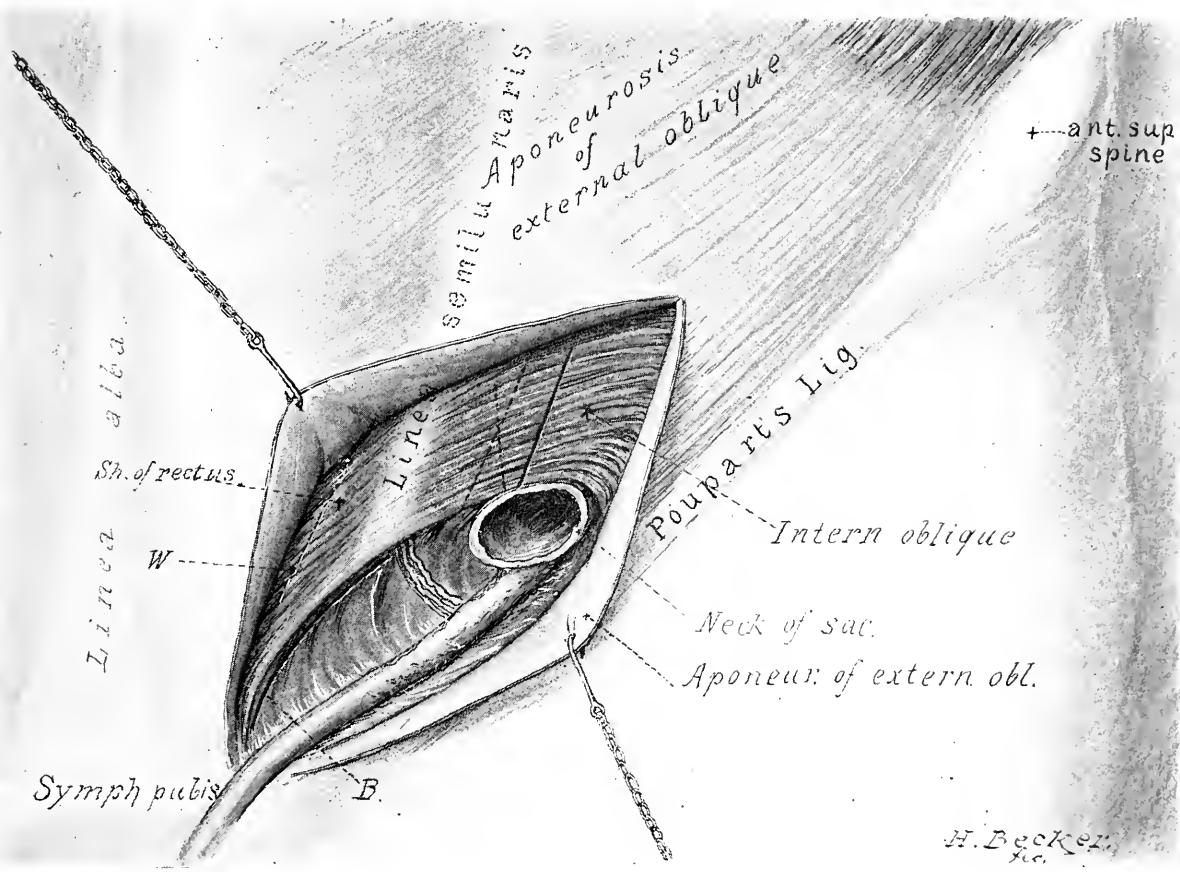


FIG. 8. The anatomy of the inguinal canal. The straight line on the internal oblique muscle represents the correct direction and extent of its division. The dotted lines represent the direction and position which should be avoided in dividing the muscle. (W) the direction and extent of the division of the anterior sheath of the rectus in Wölter's method. (B) the direction and extent of the division of the fascia to expose the rectus muscle in the writer's method. (B) also represents the extent of the conjoined tendon if it is wide and firm; if it is obliterated the transplanted rectus muscle covers this portion of the inguinal canal.



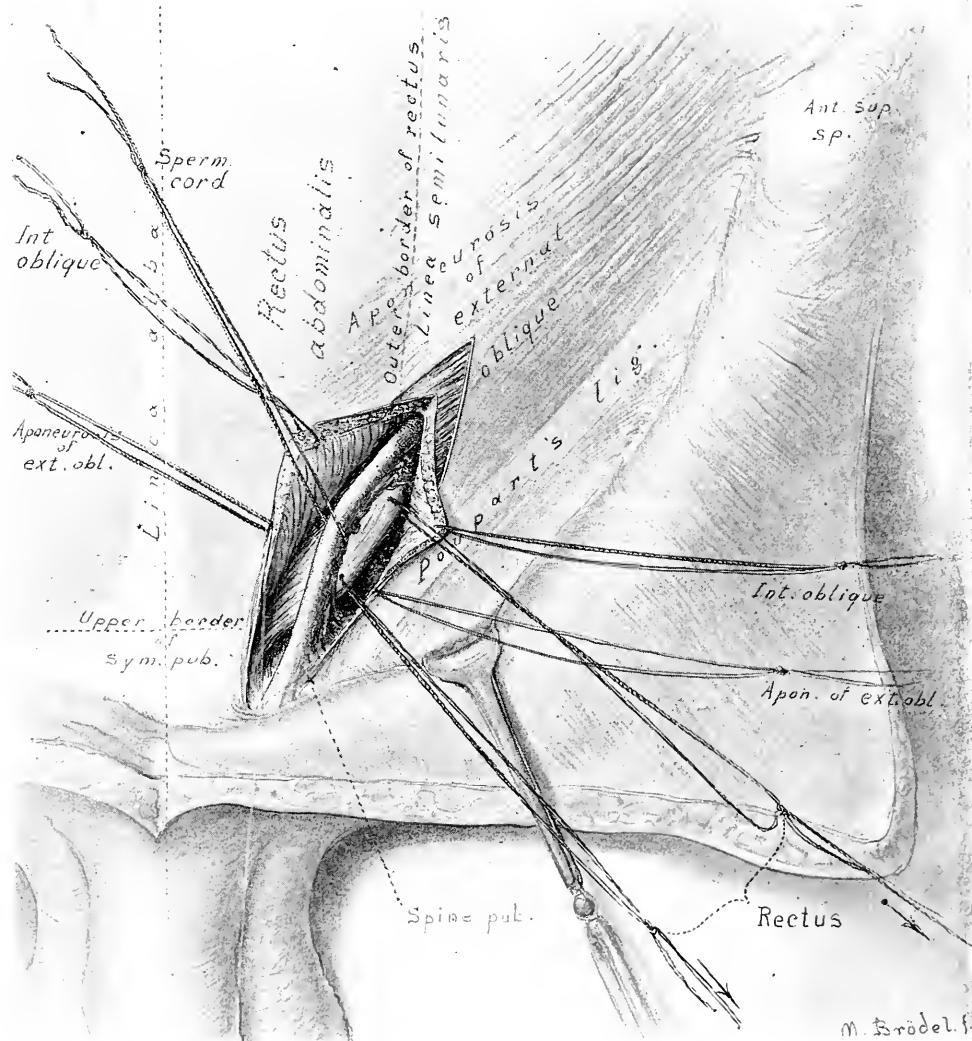


FIG. 9. The method of transplanting the rectus muscle. The sac has been excised and peritoneal cavity closed; internal oblique muscle has been divided, the rectus exposed and transplanted; at this stage the wound is ready for the deep sutures. This drawing shows how perfectly the transplanted rectus muscle lines the lower half of the wound.



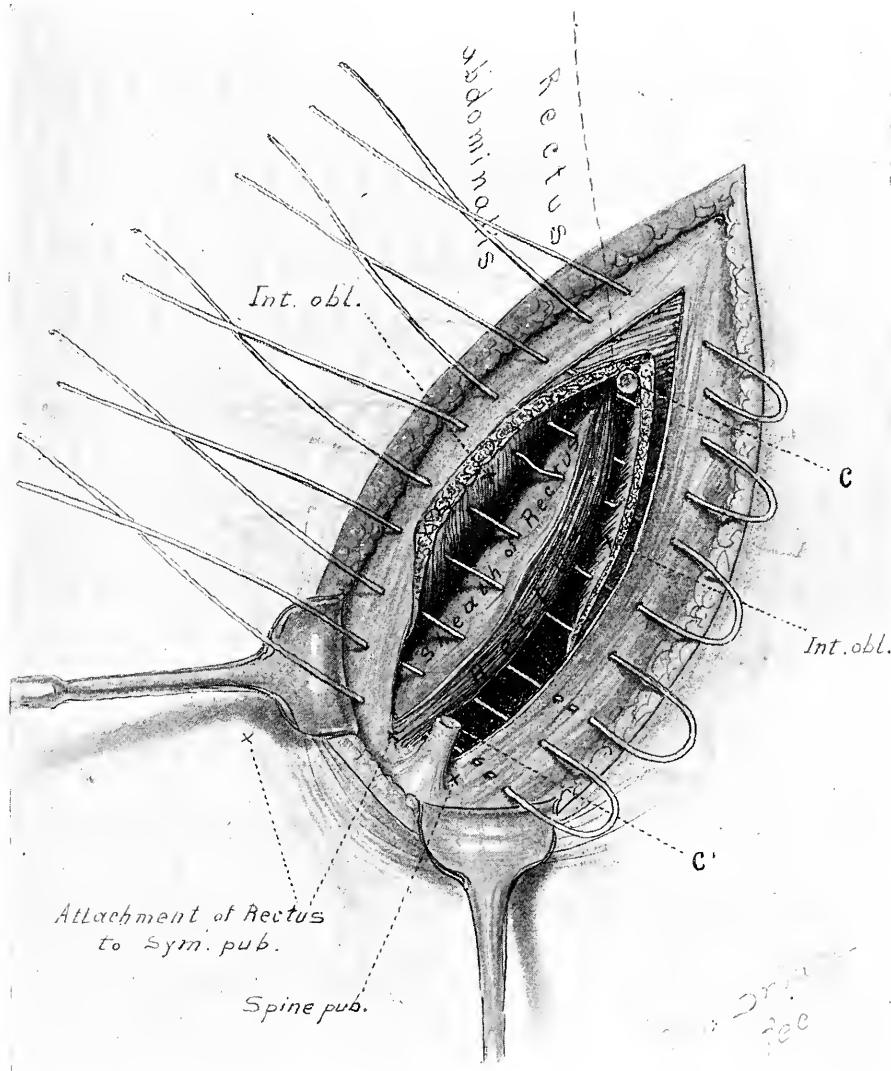


FIG. 10. The transplanted rectus included by the deep sutures. In this drawing the cord has been excised in order to demonstrate the operation more clearly.



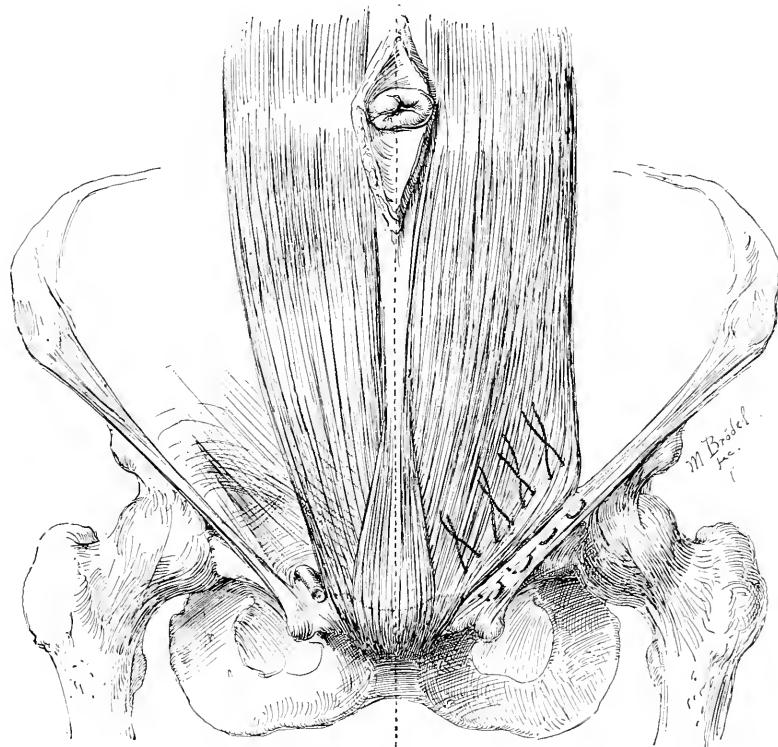


FIG. 11. Diagram of the position of the transplanted rectus muscle, demonstrating the slight change in the direction of its fibres.





PHOTO No. 1.

*Case No. 27, Group IV.*—Et. 84 years. Anaesthetic, cocaine. Very large hernia, and hydrocele.



PHOTO No. 3.

*Case Nos. 57-58, Group I.*



PHOTO No. 2.

*Case No. 27, Group IV.*—Result two months.



PHOTO No. 4.

*Case Nos. 57-58, Group I, and No. 2, Group IX.* Very large double inguinal and small umbilical. Child, wt. 21 months. Result 4 years; perfect.



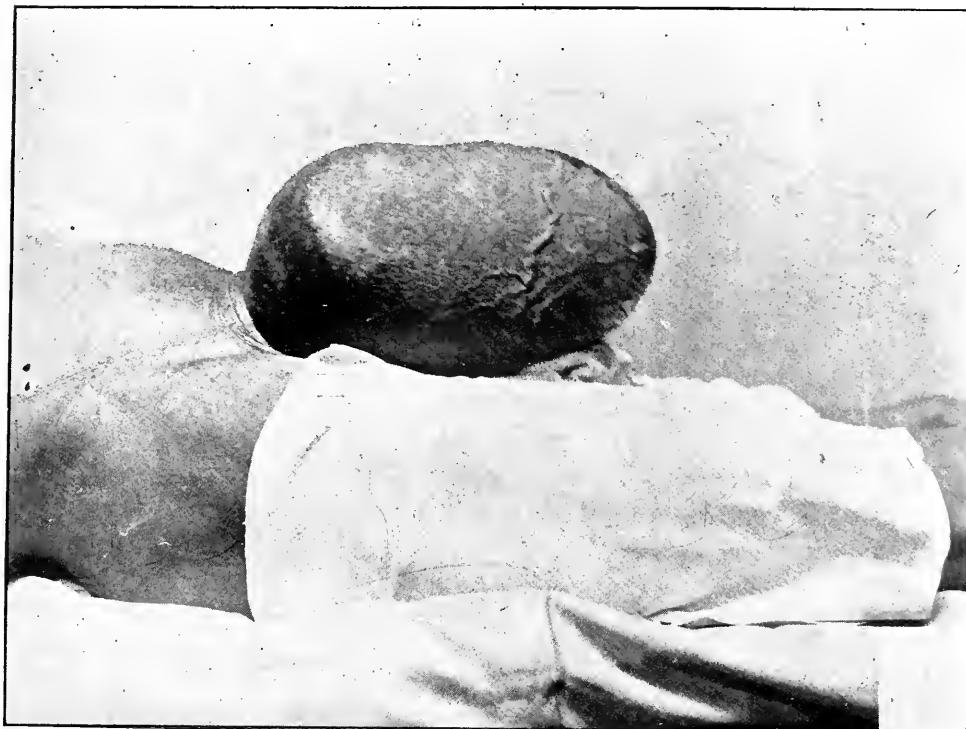


PHOTO NO. 5.

*Case No. 4, Group XI.*—Very large strangulated hernia. Gangrene of the intestine; death.



PHOTO NO. 6.

*Case No. 14, Group IV.*—Very large hernia in a child at. 5 yrs.



PHOTO NO. 7.

Perfect result, Halsted operation, boy at. 15 yrs. High skin incision.





PHOTO NO. 8.

*Case No. 1, Group I.*—Very large hernia; first operation; Halsted method.

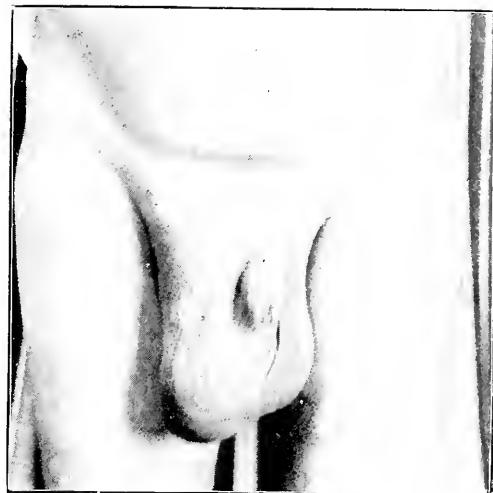


PHOTO NO. 9.

*Case No. 20, Group II.*—Very large hernia.



PHOTO NO. 10.

*Case No. 6, Group I.*—Large hernia.

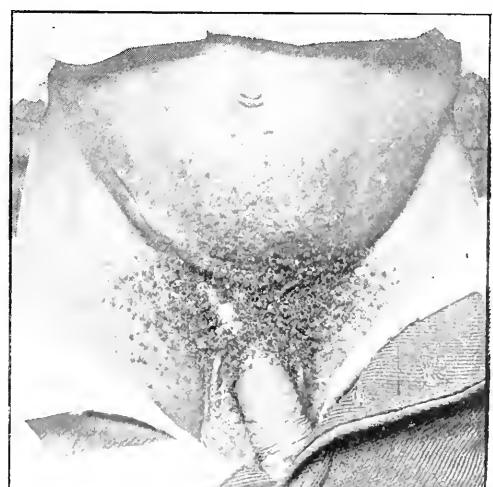


PHOTO NO. 11.

*Case No. 6, Group I.*—(See Photo No. 10.) Recorded as a partial recurrence at the position of the transplanted cord (R). Photograph taken 6 years after operation.





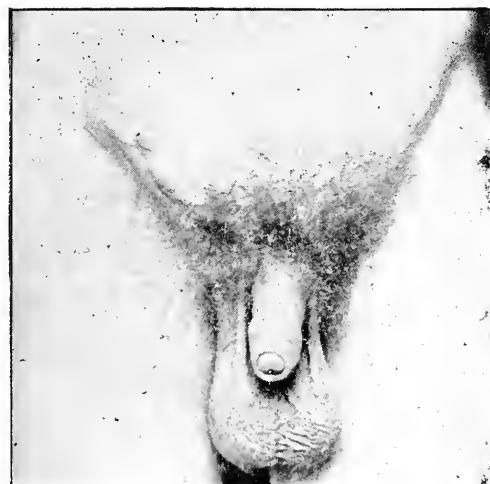
PHOTO No. 12.

*Case No. 5, Group III.*—Recorded as a complete recurrence in the lower angle of the wound, right side; conjoined tendon obliterated; wound healed p. p. Also hernia of the left side.



PHOTO No. 13.

*Case No. 33, Group I.*—Recorded as a weakness in the scar (W); bulging; no opening; no impulse; probably a hydrocele of the cord.



(R)

PHOTO No. 14.

*Case No. 21, Group I.*—Recorded as a partial recurrence at the position of the cord (R); wound suppurated. Photograph taken 5 years after operation.



(R)

PHOTO No. 15.

*Case No. 2, Group I.*—Recorded as a partial recurrence at the position of the cord (R). Photograph taken 6 months after operation, showing sinus from a stitch abscess and bulging.



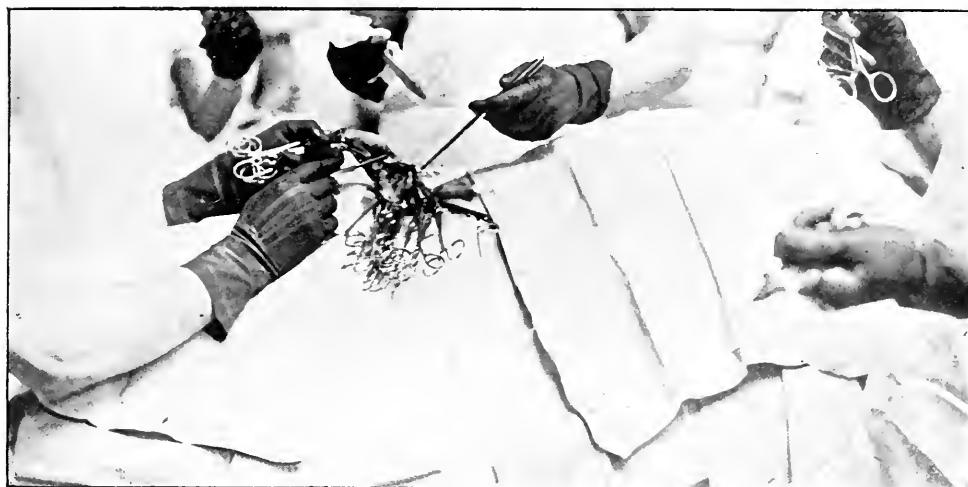


PHOTO No. 15.

The dissection of the sac from above downwards. The use of rubber gloves.



PHOTO No. 16.

*Case No. 7, Group IX.*—Very large umbilical hernia.



PHOTO No. 17.

*Case Nos. 5 and 6, Group III.*—Perfect result right side; slight bulging left side (W); wound suppurated.



## HISTORIES OF THE CASES IN DETAIL.

Group	Recorded cases. June 1889 to January 1890. Radical Operation.	Recent cases, not recorded, Jan. to June, 1890.		
		Recorded	Recent	Total
	I. Halsted's operation, cord trans- planted	268	15	283
I (A).	Veins only transplanted	2	24	26
	II. Cord not transplanted	25	11	36
	III. Cord excised	20	4	24
	IV. Castration	27	2	29
	V. Female	39	4	43
	VI. McBurney's operation	7	—	7
VII.	Testicle replaced in the abdominal cavity (Cushing)	4	—	4
VIII.	Bassini's operation	2	—	2
IX.	Ventral hernia (22 operations). Umbilical	12	2	14
	Ventral (subserous fat)	3	—	3
	Hernia in linea semilunaris	1	—	1
	Hernia following operation for appendicitis (gauze drain)	2	1	3
	Hernia following incision in the groin for rupture of the bladder	3	—	3
	Traumatic ventral hernia (strangulated)	1	—	1
X.	Femoral hernia	25	2	27
	Total radical operations	441	65	506

## OPERATION, NOT RADICAL. 18 CASES.

Group	XI.	Strangulated herniæ. Intestine gangrenous or general peritonitis. 10 cases: Inguinal 4 cases; umbilical 1 case; femoral 5 cases.	1	11
	XII.	Irreducible inguinal hernia, radical operation impossible because of the extensive matting together of the intestines in sac. Number of cases 4, three of which were strangulated.	—	—
	XIII.	Odd cases 4.	—	—

- (1). Umbilical hernia with extensive tuberculosis of the peritoneum, resection and intestinal suture. Death.
- (2). Chronic obstruction of the bowels following the reduction of a strangulated inguinal hernia. Operation. Death.
- (3). Reduction "en bloc" of an inguinal hernia. General peritonitis. Operation. Death.
- (4). Death on the table before operation was completed. Strangulated inguinal hernia. Gumma of the cerebellum.

Note, June, 1899. Among the recent cases not recorded operated on since January, 1899 (60 cases inguinal hernia), one recurrence has been observed, Group III, Cases 23-24, Surg. No. 8445. The patient was a feeble old man aged 71 years. The operation was done under cocaine, right side (28-12-'99), left side (30-1-'99) (Cushing). The recurrence has just been observed in the lower angle on the left side. Cushing notes that at the operation on the left side, the rectus muscle, which was transplanted, was "very thin and tendinous," but the wound was sutured "very satisfactorily." The conjoined tendon was obliterated. The wound healed per primam. This represents the first recurrence in 53 cases in which the rectus muscle has been transplanted.

#### GROUP I. HALSTED'S OPERATION. 268 CASES.

*June 1889 to June 1890. 7 Cases.*

Case 1. Perfect result; last examination June 1891, 2 years after operation. One month later patient died of tuberculosis of the lungs with no recurrence of the hernia.

Surgical No. 30. W. H. R., æt. 8 years; colored. Very large, right inguinal hernia; reducible, complete, indirect, acquired. Operation 10-6-'89, Halsted. The sac contained cæcum and appendix. The appendix was adherent to the sac. After the division of the adhesions both were returned. The aponeuroses of the external oblique and the internal oblique muscle were then divided and the cord transplanted up into the outer angle of the divided muscle and the wound closed with silk. The veins were not excised. A small gauze drain was placed at the lower angle of the wound, which was removed at the first dressing on the 10th day. Healing per primam. 2 months after operation the patient was re-admitted with a small sinus leading to a silk stitch, which healed in about 2 weeks. June 1891, 2 years after operation, examination, wound solid. testicle normal. August 1891, 2 years 3 months after operation, patient died of tuberculosis of the lungs, with no recurrence of the hernia. Photograph No. 8.

Case 2. Partial recurrence in the upper angle of the scar. Secondary stitch abscess and sinus. Last examination December 1897, 8 years 6 months after operation. Last report, by letter, August 1898, no change.

Surgical No. 31. G. H., aet. 20; blacksmith. Large, right inguinal hernia; reducible, complete, indirect, acquired, of 2 months' duration, forming 24 hours after the injury. Truss of no value. Operation 17-6-'89, Halsted. Veins not excised. Cord transplanted in the divided muscle. Wound closed with silk. Small gauze drain. The patient got out of bed on the 2nd day and was discharged on the 10th day for insubordination. The wound healed per primam. Secondary stitch abscess 1 month after operation; sinus 2 months. June 14, 1892, examination, 3 years after operation: In the upper angle of the wound there is an opening which admits the index finger. On standing or coughing there is a small bulging 2 x 2 cm. in diameter. The patient noticed this bulging 6 months after operation and states that it has not increased in size since. It gives absolutely no discomfort and he does not wear a truss. The testicle is normal. December 1897, examination, 8 years 6 months since operation. No change since last examination, testicle normal. August 28, 1898, letter, no change. April 1899, examination, no change.

Case 3. Perfect result; last examination August 1898, 9 years since operation. Bladder injured at the operation by one of the deep sutures; wound completely opened on the 5th day because of extravasation of urine.

Surgical No. 94. J. B., aet. 48; blacksmith. Very large, right inguinal hernia; reducible, complete, indirect, acquired, of 15 years' duration, of rapid formation, following heavy lifting. Within the last few months the hernia has gradually increased in size, and the truss which was worn with comfort before is now of very little value. Operation 16-8-'89, Halsted. Veins not excised; wound closed with silk. Following the operation the patient had fever between 102° and 103° and a rapid pulse, and suffered a good deal of discomfort from the wound. On the 5th day the wound was opened; it was found to be full of extravasated urine. Wound healed by granulation in 5 weeks, during which time all of the deep sutures were discharged. May 1894, examined, 4 years and 8 months. The scar is depressed, the wound solid, and testicle normal. Patient is a blacksmith, and since operation has been able to return to his heavy work. Subsequent examinations: January 1896, December 1896 and August 1897, 1898, last examination 9 years after operation; wound solid, testicle normal, perfect result.

Case 4. Perfect result; last examination August 1897, 7 years 4 months. Last report August 1898, well.

Surgical No. 173. F. F., aet. 7. Small, right inguinal hernia; reducible, indirect, complete, congenital, present since 1 year of age. No truss has been worn. Operation 12-10-'89, Halsted. Veins not excised. Small gauze

drain. Healing p. p. April 1895, 5 years and 5 months after operation, no recurrence, no atrophy of testicle. August 1897, examined, 7 years 10 months, perfect result, wound solid, testicle normal. August 1898, letter, well, 8 years and 10 months since operation.

Case 5. Perfect result; last examination October 1894, 4 years and 8 months since operation. Testicle retracted up under skin over pubes after operation; in place and normal in October 1894.

Surgical No. 250. J. W. F., aet. 12; colored boy. Small, left inguinal hernia; reducible, indirect, acquired, complete. Rupture followed 1 year after a kick in the abdomen. Operation 21-12-'89, Halsted. Veins not excised. Healing p. p. After the operation it was noticed that the testicle was drawn up above the pubes. October 1894, examination, 4 years 8 months, wound solid, external ring solid, testicle in place and normal in size. October 1897, patient cannot be found.

Case 6. Slight recurrence in the upper angle of the scar above the transplanted cord. Last examination August 1898, 8 years and 8 months after operation. The ultimate result is shown in photographs Nos. 10 and 11.

Surgical No. 339. H. S., aet. 37; stevedore. Large, right inguinal hernia; reducible, indirect, acquired, complete, of 2 years' duration, of slow formation, following heavy lifting. Truss of no value. Operation 21-2-'90, Halsted. Veins not excised; wound closed with silk. The sac contained intestine which was adherent at a few points. One year after operation patient was exhibited at the medical society as a perfect result. March 1892, examined, 2 years; wound solid, testicle normal. July 1893, examined, 3 years and 4 months, wound solid. March 1894, examined, 4 years (Bloodgood); the scar is a fine line 12 cm. long. Two cm. below the upper end of the incision one feels a depression in the scar, which hardly admits the index finger (less than 1 cm. in diameter); when the patient stands, one sees at this point a slight bulging and when the patient coughs there is a slight impulse; remainder of the wound is solid and testicle normal. The patient is not aware of this weak place. November 1896, examined, 6 years and 8 months; entire wound is solid; small opening noted at the last examination cannot be demonstrated. October 1897, examination, 7 years and 8 months (Bloodgood). The small opening noted at the examination in 1894, and not found in 1896, is again present. Patient is not aware of its presence, and considers himself a perfect result. The photograph No. 11 shows the condition of the wound at this examination. August 1898, examination, no change. June 1899, examination, no change.

Case 7. Very slight weakness in lower angle of scar. Examined August 1898, 8 years after operation. Direct hernia. Conjoined tendon obliterated.

Surgical No. 460. J. H., aet. 39. Small, left inguinal hernia; reducible, direct, complete, of 6 weeks' duration, following lifting. Also has a hernia

on the right side of 6 years' duration. Operation 9-5-'90, Halsted. Veins not excised. Cord only partially transplanted. Wound opened in the afternoon for haemorrhage; closed on the 3d day. Healing p. p. Patient lost track of. August 1898, the patient is re-admitted for malaria, 8 years since operation, and considered himself cured. Examination: Upper two-thirds of the wound solid; in the lower third, corresponding to the position of the external ring and conjoined tendon, there is a slight bulging and impulse; the tissue feels distinctly thinner than over the remainder of the wound; testicle normal. Small, reducible, incomplete, right inguinal hernia. Conjoined tendon distinctly obliterated.

*June 1890 to June 1891.*

Case 8. Small bulging in scar of a stitch abscess. Last examination April 1893, 3 years and 8 months. Last report (letter) January 1897, 6 years 4 months. Phlebitis of left leg 10th day after operation.

Surgical No. 638. J. C. H., aet. 27; farmer. Large, left inguinal hernia; reducible, acquired, indirect, complete, of 2 years' duration, following rapidly after an injury in the groin while lifting. A truss cannot be worn on account of pain. Operation 24-9-'90, Halsted. Healing p. p. Phlebitis in the left leg, beginning on the 10th day. 3 weeks after discharged a small stitch abscess formed. April 1893, 3 years and 8 months after operation, there is a slight impulse in the scar corresponding to the seat of the abscess, which gives no discomfort. January 1897, 6 years 4 months, the patient writes that the result is a perfect one and that the testicle is normal in size. April 1899, examination, the swelling is a distinct recurrence at the position of the cord.

Case 9. Lost track of since operation. Complete suppuration of the wound. Large, very adherent omental hernia.

Surgical No. 642. G. S., aet. 49; carpenter. Large, left inguinal hernia; irreducible, acquired, indirect, complete, of 2 months' duration, following immediately after an injury in the groin. The hernia has never been completely reducible, and a truss could not be worn. Operation 29-9-'90, Halsted. Veins not excised. A long, difficult operation due to the omental adhesions. A large mass of the omentum ligated and excised. The wound was opened on the 11th day for suppuration, and healed in 9 weeks by granulation. All the buried sutures came away. Patient lost track of.

Case 10. Lost track of since operation.

Surgical No. 654. C. M., aet. 4. Large, right inguinal hernia; reducible, complete, congenital. Operation 7-10-'90, Halsted. Veins not excised. Healing p. p. Patient lost track of.

Case 11. Small bulging in scar of a stitch abscess. Last examination May 1892, 1 year 8 months.

Surgical No. 695. C. M., aet. 20; Italian fruit-dealer. Large, right inguinal hernia; reducible, complete, indirect, acquired, of 4 years' duration.

following a fall. Hernia small at first, but has grown gradually larger. Truss not worn. Operation 26-11-'90, Halsted. Veins not excised. At the end of the 3d week a small stitch abscess formed in the upper third of the wound, which was opened and healed by granulation. 8 months after operation there was a slight bulging and an impulse in the upper angle of the wound. May 1892, 20 months after operation, there has been no increase in size of the recurrence. It gives no discomfort. November 1897 and September 1897, patient cannot be found.

Case 12. Perfect result; last examination April 1892, 1 year 4 months. Last report (letter) September 1897, 6 years 11 months.

Surgical No. 707. M. McS., aet. 3. Large, right inguinal hernia; strangulated (hernia of 3 years' duration), acquired, indirect, complete. Operation 10-11-'90, Halsted. Sac contained cæcum and a large piece of the ileum, which were slightly adherent. Veins not excised. Healing p. p. April 1892, 1 year and 4 months after operation, no recurrence, testicle normal. September 1897, 6 years 11 months, parents write that the result is a perfect one.

Case 13. Perfect result; last examination April 1892, 1 year and 2 months.

Surgical No. 796. S. P., aet. 30; mechanic. Small, right inguinal hernia; direct, reducible, complete, of 11 years' duration and gradual formation. No history of injury. Has not worn a truss. Operation 29-1-'91, Halsted. Veins not excised. Healing p. p. April 1892, 1 year and 2 months after operation, no recurrence. November 1896 and September 1897, patient cannot be found.

Case 14. Perfect result; last examination January 1897, 6 years.

Surgical No. 836. F. S., aet. 27; baker. Small, left inguinal hernia; reducible, acquired, complete, of 2 months' duration, following typhoid fever. Has not worn a truss. Operation 6-2-'91, Halsted. Veins not excised. Healing p. p. November 1894, 3 years and 8 months after operation, no recurrence, scar 11 cm. long and 1 cm. in width, testicle normal. January 1896, examined, 4 years 11 months, perfect result, testicle normal, vas deferens palpable beneath skin. January 1897, examined, 6 years, perfect result, testicle normal, wound solid about cord, which can be felt beneath skin, external ring closed, no impulse.

Case 15. Patient lost track of since operation.

Surgical No. 804. J. W., aet. 28; laborer. Small, right inguinal hernia; reducible, complete, indirect, acquired, of 6 years' duration. No history of cause; no truss worn. At intervals the hernia is painful and of late has been increasing in size. Operation 23-1-'91, Halsted. Veins not excised. Sac has a very thin wall. Healing p. p. Patient lost track of.

Case 16. Perfect result; last examination March 1892, 1 year.

Surgical No. 857. J. L., æt. 14. Small, left inguinal hernia; reducible, complete, indirect, acquired, of 3 years' duration, following a kick in the groin. A truss has been worn 1 year. Operation 20-2-'91, Halsted. Veins not excised. On the 12th day a small stitch abscess was opened in the lower third of the wound; otherwise healing p. p. Patient got out of bed on the 11th day against orders. March 1892, 1 year after operation, examined, no recurrence, testicle normal. November 1896, patient lost track of.

Case 17. Perfect result; last report (letter) March 1894, 3 years.

Surgical No. 884. J. R., æt. 7. Small, left inguinal hernia; reducible, complete, indirect, acquired. Operation 17-3-'91, Halsted. Veins not excised. The bladder was distinctly in view during the operation. Healing p. p. March 1894, 3 years after operation, a letter from parents states no recurrence. November 1896, patient lost track of.

Case 18. Perfect result; last examination March 1894, 3 years. Last report (by physician) September 1897, 6 years 7 months.

Surgical No. 867. J. T., æt. 47; farmer. Small, right inguinal hernia; reducible, complete, indirect, acquired, of 6 weeks' duration, following heavy lifting. Operation 24-2-'91, Halsted. Sac very small. Veins not excised. Healing p. p. March 1894, 3 years after operation, examined, no recurrence, no atrophy of testicle. September 1897, letter from physician and patient, wound solid, testicle normal, perfect result.

Case 19. Patient lost track of since operation.

Surgical No. 961. M. P., æt. 35; laborer. Small, left inguinal hernia; reducible, congenital, present since birth. Truss not worn. Operation 8-5-'91, Finney. Veins not excised. Bronchitis with much coughing followed operation. On the 13th day upper two-thirds of the wound opened on account of a stitch abscess. Healing by granulation. Patient lost track of.

Case 20. Patient lost track of since operation.

Surgical No. 979. F. S., æt. 14 months. Small, left inguinal hernia; reducible, complete, congenital, present since birth. Operation 19-5-'91, Finney. Veins not excised. Healing p. p. Patient lost track of.

*June 1891 to June 1892.*

Case 21. Partial recurrence in upper angle of wound. Wound completely opened for haemorrhage and suppuration. Last examination October 1897, 6 years 3 months.

Surgical No. 998. E. J. C., æt. 23; box-cutter. Large, right inguinal hernia; reducible, complete, acquired, indirect, of 6 years' duration, fol-

lowing heavy lifting. Patient has had 4 attacks, in which the hernia was irreducible, associated with pain, but no nausea. Has worn a truss for the last 4 years. Operation 5-6-'91, Halsted. Veins not excised. Wound closed with silk. The operation was a very difficult one, due to the adhesions of the sac to the surrounding tissues and to a large mass of adherent omentum, which was also excised. The opening into the peritoneal cavity was closed with silk. The cord was transplanted. Following the operation the dressings became very quickly stained with blood. Within 24 hours the temperature rose to 103.5° (F.), and in 36 hours to 105° (F.). The temperature remained between 104° and 105° on the second, third and fourth days, and between 102° and 103° on the fifth and sixth days. On the second day 2 of the subcutaneous interrupted sutures of silk were cut and the wound partly opened. There seemed to be no evidence of infection. Wound completely opened on the 7th day for suppuration. On opening the wound it was found that the upper third was distended with blood and 2 bleeding vessels required ligature. All of the deep sutures were discharged. The patient got out of bed at the end of the 5th week and was discharged at the end of the 6th week, the wound having completely healed except a small granulating area. Examination April 1892, 8 months after operation: In the upper angle of the wound there was a bulging and an impulse on coughing; the bulging was reducible; the opening into the peritoneal cavity measured 2.5 cm. It gave little or no discomfort and was situated at about the position of the transplanted cord and in that part of the wound which was distended with blood. The patient was re-admitted June 8, 1892 (10 months after the first operation). Surgical No. 1667. Second operation 9-6-'92, Finney. Excision of the sac and closure of the opening in the peritoneum with silk. Approximation of the scar tissue about the opening into the peritoneal cavity with buried mattress sutures of silk. The history states that the cord was recognized at this operation and that the recurrence had taken place along the transplanted cord. At this second operation there is no note stating that the scar tissue was excised or that there was any attempt to get fresh muscle surfaces to approximate. The wound was opened on the 7th day for suppuration and all of the deep sutures discharged. Healing took place in 4 weeks. February 1894, one year and 8 months after the second operation, patient writes that within 8 months after the operation a bulging and impulse were noticed at the position of the first recurrence. Examination January 1896, 4 years and 7 months since the first operation, 3 years and 5 months since operation for recurrence: There is a bulging in the upper angle of the wound, 2 by 1.5 cm., which disappears when the patient lies down. The opening is about 1 cm. in diameter. It gives no discomfort and has not increased in size since it first appeared 3 years ago. The remainder of the scar has stretched, being 1.5 to 2 cm. in width, and is very irregular. The tissues of the deeper wound seem also to have stretched. There is no atrophy of the testicle. The epididymis is soft. There is a small varicocele and a small hydrocele, which have appeared within the last 6 months. As far as the patient is concerned the result is a perfect one. December 1896, examination, 5 years 6 months, no change. May 1897, letter, 6 years, no change. October 1897, examination, 6 years 3 months, no change. Photograph No. 14. The result is practically a perfect one.

Case 22. Partial recurrence in the lower angle of the wound April 1897, 5 years and 8 months after operation. The wound was opened on the fourth day because of acute infection and distention with blood. Second operation April 23, 1897 (see Group IV, Case 19, Surgical No. 6497). Last examination March 1898, 11 months since second operation. Letter September 1, 1898, well.

Surgical No. 1046. F. D., aet. 49; box-cutter. Large, right inguinal hernia; is reducible for one day, complete, indirect, acquired, of 35 years' duration, following heavy lifting. Operation 26-6-'91, Halsted. Veins not excised. Wound closed with silk. Excision of small hydrocele. Wound opened on the fourth day because of a rise of temperature to 105° (F.), and of symptoms of acute infection. The wound was found to be distended with blood. Healing in 10 weeks. Patient was discharged with a single stitch sinus in the lower angle of the wound, which did not heal for 8 months. April 1892, examined, 10 months: The scar is depressed and 1 cm. in width; the epididymis is indurated, testicle normal. October 1894, 3 years and 8 months, letter, well. April 1897, 5 years and 8 months, examination, there is a bulging in the lower angle of the scar just above the pubes. The scar has stretched 2 cm. in width; the bulging measures 2 x 2 cm. and does not descend down into the scrotum; it is partially reducible; testicle is normal. The patient states that he noticed the bulging 1 month ago. Previous to its appearance he had suffered for 3 months with a very severe cough and had been ill some time in bed. Operation was advised. April 23, 1897, re-admitted with symptoms of strangulation (for second operation see Group IV, Case 19, Surgical No. 6497). It was found at the second operation that the conjoined tendon had given away.

Case 23. Perfect result; last report (letter) September 1897, 6 years 1 month.

Surgical No. 1075. P. H., aet. 5. Small, left inguinal hernia; reducible, complete, indirect, acquired, of 3 years' duration. Operation 11-8-'91, Finney. Veins not excised. Healing p. p., except the skin over the lower third of the wound, which healed by granulation. Two months after operation patient returned with a small stitch abscess. October 1894, 2 years and 9 months after operation, the parents write that there is no recurrence. March 1896, letter, 5 years 6 months, well. September 1897, letter, well, 6 years 1 month.

Case 24. Patient lost track of since operation.

Surgical No. 1077. P. C., aet. 28; laborer. Small, right inguinal hernia; reducible, incomplete, direct, of 4 years' duration. Truss not worn. The rupture gives no discomfort, but the patient desires operation. Operation 16-7-'91, Halsted. The sac has a thin wall and there is no constriction at the neck. Veins not excised. Closed with silk. Healing p. p. Patient lost track of.

Case 25. Perfect result; last examination March 1894, 2 years 8 months. Last report (letter) September 1897, 6 years 2 months.

Surgical No. 1085. W. C. W., æt. 2 years 6 months. Small, right inguinal hernia; reducible, complete, congenital, of 2 years' duration. Has not worn a truss. Operation 25-7-'91, Finney. Sac very small. Muscle not split, cord therefore not transplanted in muscle, but brought out between the fascia and placed between the skin and the aponeurosis of the external oblique. Wound closed with silk. Healing p. p. Highest temperature 99.5°. March 1894, 2 years and 8 months, examination, wound solid. The testicle has been drawn up into the inguinal canal for the last 6 months. September 1897, 6 years 2 months, the parents write that the boy is well, testicle in place and normal in size.

Case 26. Perfect result; last examination March 1894, 2 years 8 months; last report (letter) November 1894, 3 years 3 months.

Surgical No. 1106. G. B., æt. 22; clerk. Small, right inguinal hernia; reducible, complete, acquired, present since birth. A truss was worn from the age of 8 to that of 14 years. At intervals the hernia gives pain and always interferes a great deal with lifting. Operation 4-3-'91, Halsted. Veins not excised. Healing p. p. March 1894, 2 years and 8 months after operation, examined, no recurrence, no atrophy of testicle. November 1894, 3 years 3 months, patient writes that he is still well.

Case 27. Perfect result; last examination October 1897, 6 years and 2 months since operation.

Surgical No. 1117. A. McS., æt. 26; waiter. Small, right inguinal hernia; strangulated 1 day, complete, indirect, acquired, of 4 years' duration and slow formation. Truss worn. Operation 9-8-'91, Finney. *Veins excised because they were very large.* A hydrocele was present which was not opened. Closed with silk. Healing p. p. except 2 cm. of the upper portion of the skin wound. February 1894, 2 years and 9 months after operation, the hydrocele and testicle were removed at the request of the patient. There was no recurrence of the hernia. January 1895, 3 years and 4 months after operation, examined: Wound solid. October 1897, 6 years 2 months, examined: Wound solid. Note: Microscopic examination of the removed testicle showed no change.

Case 28. Recurrence at the position of the transplanted cord. Veins not excised. Wound healing per primam.

Surgical No. 1141. M. W., æt. 11. Small, right inguinal hernia; reducible, complete, congenital. Operation 27-8-'91, Finney. Veins not excised. Healing p. p. Examination March 22, 1899, there is a large recurrence in the upper angle at the position of the transplanted cord. The patient has not presented himself for examination before. He states that he noticed the recurrence about 8 months after operation. It has not increased much in size since then; a period of 8 years. The hernia is reducible and the opening in the abdominal wall admits the index finger. Second operation

31-3-99, Halsted. The veins were found to be large. The sac of the recurrent hernia was situated above and was adherent to the veins. During the excision of the scar tissue, the vas deferens was injured. It was therefore ligated and excised. In closing the wound the veins were transplanted and the divided internal oblique muscle and the transplanted rectus muscle were included in the sutures. See Group I (A), Case 26, Surgical No. 8763. The wound healed per primam. Following the operation there was some swelling of the testicle and induration of the epididymis, which had not completely disappeared when the patient left the hospital.

Case 29-30. Perfect result; last examination August 1897, 6 years after operation.

Surgical No. 1205. G. B., aet. 3 years. Small, right and left inguinal herniæ; reducible, acquired, incomplete, indirect. Operation 30-9-91, Halsted; ether, right side. Veins not excised. Wound closed with silk. Interrupted subcutaneous silk to close the skin. Healing p. p. Second operation, left side, 13-1-91, Halsted; ether. Veins not excised. Wound closed with silk. Healing p. p., except about 3 cm. of the skin incision, which healed by a narrow line of granulation. March 1894, two years and two months, examination: Both wounds solid; both testicles normal. August 1897, examination, 6 years: Both wounds solid. both testicles normal. Perfect result.

Case 31. Perfect result; last examination April 1896, 4 years 6 months; last report (letter) August 1897, 5 years 10 months.

Surgical No. 1206. J. W. B., aet. 5. Small, left inguinal hernia; reducible, complete, indirect, acquired, of 3 years' duration. Hernia on the right side of 9 months' duration. The latter very small and reducible. Operation 9-10-91, Halsted. Left side. Sac very small. Veins not excised. The upper third of the wound suppurred. April 1892, 1 year and 6 months after operation, examined, no recurrence, epididymis indurated. March 1894, 2 years and 5 months after operation, no recurrence, epididymis and testicle normal; the right inguinal hernia has remained reducible since operation upon the left side; there is no evidence of the hernia. April 1896, examined, 4 years 6 months, perfect result, testicle normal; the cord is palpable beneath the skin for 2 cm. above pubis. December 1896, letter, 5 years 2 months, well. August 1897, letter, 5 years 10 months, perfect result.

Case 32. Slight weakness in scar. Last examination August 1897, 5 years 10 months. Last report, by letter, August 1898. Partial suppuration of the wound.

Surgical No. 1229. H. P., aet. 29; factory hand. Small, right inguinal hernia; reducible, complete, indirect, acquired, of 2 years' duration, following lifting. Operation 9-10-91, Halsted. Veins not excised. Upper one-half of wound opened on the 5th day after operation: 3 buried sutures of silk discharged. Wound healed by granulation in 6 weeks. March

1892, 6 months after operation, examined: In the scar in that portion of the wound which suppurred (the upper one-half) there is a slight bulging when the patient stands and an impulse on coughing. March 1894, 2 years and 11 months after operation, the bulging has not increased; it gives no discomfort. September 1894, 2 years and 6 months after operation, patient examined: the bulging has not increased, it gives no discomfort, no atrophy of testicle; patient has a very thin abdominal wall. April 1895, patient writes that the result is a perfect one. April 1896 and December 1896, examinations: bulging has not increased and gives no discomfort. August 1897, examination, 5 years and 10 months since operation: the patient's abdominal wall is thin and shows the lateral bulging sometimes found in cases of hernia; the upper third of scar is slightly more prominent than the remainder of the scar; the impulse over the upper third is not greater than over a corresponding position on the opposite side; one cm. below the upper angle of the scar one feels with the little finger a slight depression, hardly 5 mm. in diameter; at this position there is a slight impulse; testicle is normal; practically, result is a perfect one, and patient considers himself cured. August 1898, 6 years and 10 months, the patient writes that the result is a perfect one.

Case 33. Perfect result. Last examination March 1899, 7 years and 4 months; healing per primam. Photograph No. 13. Hydrocele of cord follows operation.

Surgical No. 1293. E. L. B., aet. 28; molder. Small, right inguinal hernia; reducible, incomplete, indirect, acquired, 7 months' duration, following injury to groin. The hernia was very small until 3 weeks ago, when it increased in size after a second injury to the groin. Operation 3-12-'91, Halsted. Veins not excised. February 1892, 3 months after operation, abdominal walls are very thin; there is a slight impulse between the scar and the lower third of Poupart's ligament. December 1893, 2 years after operation (see Case 71, Surgical No. 2689), the patient was operated on for a left inguinal hernia and the right side was explored; there was no evidence of a recurrence. November 1895, on the right side between the scar and lower third of Poupart's ligament there is a small bulging, reduced with difficulty, which gets larger and is quite painful when the bladder becomes distended with urine; the patient is relieved when the bladder is emptied, otherwise it gives no discomfort; it is not growing larger; it is distinctly below the healed wound and seems to be due to a split in the aponeurosis of the external oblique muscle, perhaps produced by one of the buried sutures at the time of operation. January 1897, examination, 5 years 8 months, no change, small mass irreducible. August 1897, 6 years 3 months, examination: this irreducible tumor is slightly larger and contains fluid; the entire wound is solid; result practically perfect: patient works hard and considers himself cured. August 1898, examination, no change, the small tumor is now thought to be a hydrocele of the cord. March 1899, examination (Bloodgood): bulging noted at previous examination is now distinctly movable. It is undoubtedly a hydrocele of the cord. The hernia wound behind the hydrocele is solid.

## Case 34. Patient lost track of since operation.

Surgical No. 1309. A. M., aet. 4. Small, right inguinal hernia; strangulated (2 days), acquired, indirect, of 2 years' duration, following injury. Until 2 days ago always reducible, and has given no discomfort. Truss not worn. Operation 25-11-'91, Halsted. Sac contains small knuckle of intestine, only slightly injected. Veins not excised. Closed with silk (skin of the patient was prepared rapidly on the table). Wound opened for suppuration on the 5th day; discharged in 7 weeks with a small stitch sinus, highest temperature 102°. Re-admitted 1½ months later with a stitch abscess, which was opened under ether and which healed by granulation in 2 weeks. The wound was solid. No swelling of the epididymis followed operation. Patient lost track of.

## Case 35. Perfect result; last examination October 1898, 7 years since operations.

Surgical No. 1317. H. B., aet. 21; baker. Medium, left inguinal hernia; reducible, complete, acquired, indirect, of 2 years' duration, following heavy lifting. Has worn a truss. Patient has suffered on several occasions from pain in the groin, followed by nausea. In the hospital 4 days before operation, the hernia became irreducible for 24 hours. Operation 9-12-'91, Halsted. The tissues about the sac were discolored by extravasated blood, and there were many adhesions between the sac and the surrounding tissue. Veins not excised. Healing p. p., except 2 cm. of the skin incision, which healed by granulation. Highest temperature 102.6° (F.). No swelling of testicle, followed operation. Examination, March 1895, 3 years and 3 months, scar had stretched a little, but otherwise the wound is solid and there is no recurrence of the hernia, testicle normal. January 1896, examined, 5 years, perfect result, testicle normal. April 1896, examined, 5 years 4 months, perfect result, testicle normal. September 1897 and August 1898, examined, wound solid, testicle normal. October 1898, 7 years, examined, well.

## Case 36. Perfect result; last examination August 1898, 6 years and 7 months since operation.

Surgical No. 1432. H. H., aet. 2 years. Small, right inguinal hernia; reducible, complete, acquired, indirect, present since birth. Truss not worn. Has given no discomfort. Child delicate. Operation 17-2-'92, Halsted. Sac very small and wall very thin. No adhesions. Veins not excised. Closed with silk. Healing p. p. Highest temperature 102°. Some swelling of the epididymis followed operation. January 1898, examination, 5 years 11 months, wound solid, testicle smaller, atrophy a question, no note of size before operation. August 1898, examination, no change.

## Case 37. Patient lost track of since operation.

Surgical No. 1445. A. F., aet. 30; carpenter. Medium, left inguinal hernia; reducible, complete, acquired, indirect, of 1 year's duration, following heavy lifting. Truss not worn. The rupture gives much pain and discomfort, especially during any exercise. Operation 23-2-'92, Halsted.

Veins not excised. Closed with silk. Healing p. p. Highest temperature 100°. No swelling of testicle. Patient lost track of.

Case 38. Patient lost track of since operation.

Surgical No. 1465. K. H., aet. 30; butcher. Large, left inguinal hernia; reducible, complete, acquired, indirect, of 2 years' duration. Of rapid formation, following heavy lifting. Truss not worn. Rupture gives some pain and discomfort. Operation 8-3-'92, Halsted. Veins excised. Closed with silk. Superficial skin suppuration over one-third of the wound, and one stitch sinus on discharge. Patient lost track of.

Case 39. Result uncertain; death April 1897, 5 years after operation.

Surgical No. 1563. S. L., aet. 47; sailor. Medium, left inguinal hernia; reducible, complete, acquired, of 5 years' duration, following heavy lifting, of slow formation. Truss worn 1 year. Operation 22-4-'92, Halsted. The ring admits three fingers. Some adhesions between sac and omentum. Veins small, excised. Subcutaneous fat very thick. Closed with silk. Wound opened on the 9th day for suppuration. Temperature 103°. Wound healed by granulation in 10 weeks. September 10, 1897, letter from surgeon in charge of the Marine Service of the German Hospital, Philadelphia: "The patient was admitted into this hospital April 1, 1897, and died in two weeks; on the clinical notes there is no reference to the presence of any herniæ." The surgeon-in-charge states that he distinctly remembers that there was no evidence of a hernia in the scar or in the scrotum, but there was present a ventral hernia.

Case 40. Patient lost track of since operation. Reported to be dead December 1894, 2 years 7 months. Double parotid abscess following operation.

Surgical No. 1611. J. F., aet. 38. Small, right inguinal hernia; strangulated (4 days), complete, acquired, indirect, of 2 years' duration. Has given no discomfort until the present strangulation. Operation 12-5-'92, Halsted. Sac contains intestine and adherent omentum. Intestine reduced and omentum excised. Veins not excised. Cord not transplanted as high as usual. Healing p. p. Highest temperature 105° on the 7th day, due to double parotid abscess. December 1894, 2 years and 7 months, patient reported to be dead. No history of recurrence of hernia.

Case 41. Patient lost track of since operation.

Surgical No. 1634. T. McC., aet. 9; colored. Medium, left inguinal hernia; irreducible, complete, congenital, indirect, present since birth. Has given no discomfort. Truss not worn. Operation 27-5-'92, Baltzell. Sac contains omentum adherent by one band, which was cut and the omentum reduced. Veins not excised. Closed with silk. Healing p. p., although the child tore the dressing off a number of times. No swelling of testicle. Highest temperature 102°. Patient lost track of.

*June 1892 to June 1893.*

Case 42. Patient lost track of since operation.

Surgical No. 1668. J. McN., æt. 37; laborer. Large, right inguinal hernia; reducible, complete, acquired, indirect, of 7 years' duration. Has worn a truss. Operation 10-6-'92, Finney. Veins not excised. Closed with silk. Healing p. p. Highest temperature 100°. No swelling of testicle. Patient left the hospital on the 15th day and has not been heard from since. February 1897, patient cannot be found, letter returned.

Case 43. Slight weakness in scar; wound healing p. p. Last examination April 1894, 1 year 10 months.

Surgical No. 1670. J. N. W., æt. 21; salesman. Small, left inguinal hernia; reducible, incomplete, acquired, indirect, of 2 weeks' duration, of slow formation; truss gives discomfort; operation 16-6-'92, Finney. Veins not excised; closed with silk; healing p. p. Highest temperature 101°. No swelling of testicle. Examination April 1894, 1 year and 10 months, scar is 11 cm. long and has stretched a little; between the middle third of the scar and Poupart's ligament there is an area 2½ cm. in length, beneath which the tissues of the abdominal wall are thinner than the surrounding tissues and which on coughing gives a slight impulse; this has been noticed 1 year and is not increasing; it cannot yet be called a recurrence; testicle normal. November 1897, patient lost track of.

Case 44. Perfect result. February 1893, examination, 8 months.

Surgical No. 1684. C. S., æt. 58; laborer. Medium, right inguinal hernia; partially irreducible, incomplete, acquired, indirect, of 6 years' duration. Truss not worn. Operation 23-6-'92, Finney. Sac very adherent. Veins not excised. Closed with silk. Healing p. p. Highest temperature 102°. Patient lost track of. February 1893, 8 months, examination, perfect result, lost track of since.

Case 45. Patient lost track of since operation.

Surgical No. 1734. H. R., æt. 25; barber. Medium, right inguinal hernia; reducible (with some difficulty), complete, acquired, indirect, of 8 years' duration, of slow formation. Truss has been worn 7 years. Hernia became partially irreducible 2 months ago, since which time truss has not been worn. The ring admits three fingers. Operation 9-8-'92, Finney. Veins excised. Small hydrocele opened. Closed with silk. Healing p. p. Temperature 104° on the 2nd day, lasting for 2 days only and due to dysentery. Not amœbic. Patient lost track of since operation.

Case 46. Patient lost track of since operation.

Surgical No. 1775. G. S., æt. 52; laborer. Small, left inguinal hernia; reducible, incomplete, acquired, indirect, of 10 days' duration, of rapid formation, following heavy lifting. Operation 1-9-'92, Finney. Sac very

small. In the inguinal canal, in front of the sac and adherent to the cord, was a mass of properitoneal fat, which was excised. Closed with silk. Healing p. p. except the skin wound, the upper third of which opened on the 12th day to evacuate a small blood-clot. Patient lost track of.

Case 47. Patient lost track of since operation.

Surgical No. 1851. A. B., æt. 25; laborer. Medium, left inguinal hernia; strangulated, complete, acquired, indirect. No history could be taken because the patient spoke only Polish. Operation 6-10-'92, Baltzell. Sac contains adherent omentum which was excised, and a knuckle of injected intestine which was replaced. Veins not excised. Closed with silk. Healing p. p. Highest temperature 101°. Patient lost track of.

Case 48. Perfect result; last report (letter) March 1894, 1 year 4 months. May 18, 1894, death; apoplexy; no return of hernia.

Surgical No. 1938. W. H. N., æt. 43; merchant. Small, left inguinal hernia; reducible, incomplete, acquired, indirect, of 13 years' duration and slow formation. Has worn a truss, which gives no discomfort. Operation 29-11-'92, Finney. Veins small, excised. Healing p. p. Highest temperature 100.5°. March 1894, 1 year and 4 months, patient writes that there is no recurrence. May 1894, letter, 1 year 6 months, death, apoplexy; no recurrence of hernia.

Case 49. Perfect result; last examination January 1898, 5 years 1 month.

Surgical No. 1955. C. K., æt. 22; laborer. Large, right inguinal hernia; reducible, complete, acquired, indirect, of 5 years' duration. Truss not worn. The pain and discomfort of the last few months have incapacitated him for his heavy labor. Operation 13-12-'92, Finney. Sac slightly adherent. Hour-glass in shape, which may have explained the discomfort. Veins small, excised. Closed with silk. Healing p. p. Highest temperature 101°. Subsequent examination December 1894, 2 years, scar a fine, red line, less impulse on the operative side than the other, no atrophy of testicle, a perfect result. April 1895, examined, 2 years 5 months, perfect result, testicle normal. August 1897, 4 years 8 months, letter, perfect result. January 1898, 5 years 1 month, examined, perfect result, testicle normal.

Case 50. Perfect result; last examination August 1893, 6 months.

Surgical No. 2072. J. K., æt. 23; laborer. Large, right inguinal hernia; partially irreducible, complete, acquired, indirect, of 8 years' duration, following heavy lifting. Hernia strangulated for 2 days 2 years ago. It has been partially irreducible and given much discomfort since. Patient also suffers from epileptic attacks. Operation 24-2-'93, Halsted. Sac, hour-

glass in shape. Quite adherent. Contents adherent to omentum, which was excised. Veins not excised. Closed with silk. Healing p. p. Highest temperature 102.5°. No swelling of epididymis followed operation. August 1893, examination, 6 months, no recurrence, no atrophy of testicle. Patient has not been heard from since.

Case 51. Stretching of the entire abdominal wound. Last examination November 1894, 1 year and 8 months after operation. November 1896, patient reported dead.

Surgical No. 2087. Aet. 34 (colored). Large, right inguinal hernia, reducible, complete, indirect, of 2 years' duration. Operation 23-3-'93, Halsted. Veins large, excised; wound closed with silk. Sac contained adherent omentum, which was excised. Highest temperature 102°, healing per primam. The patient got out of bed on the first day, against orders, to urinate. November 1894, examination, 1 year and 9 months, note by Dr. Halsted: "This case, which furnishes the nearest approach to a recurrence, was operated upon about 2 years ago. The man has the physiognomy of a Hindoo but is classed as a negro. He is about 35 years old, not more than half witted and was on admission and still is much emaciated and exceedingly feeble. Within the first 24 hours he got out of bed, possibly he repeated this act of disobedience daily; wound healed per primam. There is at present (but only on coughing) a bulging of the very thin, flabby abdominal wall from the inner to the outer end of the scar. The local condition is not bad enough to demand a second operation."

Case 52. Perfect result; last examination November 1896, 3 years 7 months.

Surgical No. 2183. H. Z., aet. 2 years. Small, right inguinal hernia; reducible, incomplete, acquired, indirect. Operation 17-4-'93, Halsted. Sac small. Veins small, excised. Closed with silk. Healing p. p. Highest temperature 100°. October 1894, 1 year and 5 months, parents write that there is no recurrence. January 1896, letter, 2 years 8 months, well. November 1896, examined, 3 years 7 months, perfect result, testicle normal, external ring not quite closed, no impulse.

Case 53. Perfect result; last examination September 1897, 4 years 5 months.

Surgical No. 2190. F. A., aet. 7 years. Small, right inguinal hernia; reducible, incomplete, acquired, indirect, of 2 years' duration. Truss not worn. Some pain and discomfort experienced. Operation 28-4-'93, Halsted. Sac very small. Veins small, excised. Closed with silk. Healing p. p. Highest temperature 100°. Examination October 1894, 1 year and 5 months, wound solid, no atrophy of testicle, a perfect result. January 1896, examined, 2 years 9 months, perfect result, testicle normal. March 1896, 4 years, examination, perfect result, testicle normal. September 1897, examination, 4 years 5 months, perfect result, testicle normal.

Case 54. Perfect result; last examination August 1898, 5 years and 3 months.

Surgical No. 2201. A. S., æt. 41; factory hand. Small, left inguinal hernia; reducible, incomplete, acquired, indirect,  $1\frac{1}{2}$  years' duration. Wears a truss. The skin is very much irritated by the truss. Operation 5-5-'93, Halsted. Sac small, contains a small piece of adherent omentum, which was excised. Veins excised. Closed with silk. Healing p. p. Highest temperature 100.2°. Subsequent examination, November 1894, 6 months, wound solid, stump of ligated veins still to be felt above epididymis, no atrophy of testicle, does heavy lifting, a perfect result. April 1895, examined. 11 months, perfect result. testicle normal, stump of ligated veins not to be felt; since operation the patient has been able to return to his hard work. January 1896, examined, 2 years 7 months, perfect result, testicle normal. November 1896, examined, 3 years 5 months, perfect result. testicle normal. August 1897, examined, 4 years 3 months, perfect result. testicle normal. August 1898, examined, perfect result.

*June 1893 to June 1894.*

Case 55. Perfect result; last examination November 1894, 1 year 5 months; last report (by physician) October 1897, 4 years 4 months.

Surgical No. 2290. J. K., æt. 43; carpenter. Medium, right inguinal hernia; reducible, complete, acquired, indirect, of 10 years' duration and slow formation, due possibly to the constant pressure in the right groin while at work at his bench. Rupture now incapacitates him for work. Operation 9-6-'93, Halsted. The subcutaneous fat was very thick. Sac small. Walls thin. A small mass of properitoneal fat in front of the sac. Veins large, excised. In passing a deep suture a large vein was punctured, requiring quite a dissection before it could be found and tied. Closed with silk. The patient took ether badly and was cyanosed during the entire operation, and vomited frequently. Pneumonia, with a temperature of 103°, developed on the 2nd day. The wound suppurred. It was opened on the 10th day. Patient discharged in 12 weeks with 2 stitch sinuses. In 6 months silk sutures were discharged from these sinuses, after which they healed rapidly. Subsequent examination. November 1894, 1 year and 5 months, the wound is absolutely solid, no atrophy of testicle, epididymis is slightly indurated, patient is able to work hard at his bench, a perfect result. January 1896, 2 years 6 months, letter from patient, perfect result. October 1897, 4 years 4 months, report from physician, perfect result.

Case 56. Perfect result; last examination September 1897, 4 years and 3 months since operation; last report (by letter) September 1898, 5 years.

Surgical No. 2294. S. D., æt. 5. Small, left inguinal hernia; reducible, complete, acquired, indirect. Operation 14-6-'93, Halsted. Sac very adherent. Veins small, excised. Closed with silk. Healing p. p., except 2

cm. of the upper portion of the skin wound, which healed by granulation. February 1894, 7 months, returns for operation on the right side; there is no recurrence on the left side; no atrophy of testicle (see Case 75, Surgical No. 2301). January 1896, examination, 2 years 6 months, wound solid, external ring closed, testicle and epididymis normal. November 1896, letter, well. September 1897, examination, 4 years 3 months, wound solid, external ring closed, testicle and epididymis normal, perfect result. Letter September 1898, perfect result.

Case 57-58. Perfect result; last examination June 1898, 5 years after operation. Triple herniæ, double inguinal and umbilical. Photographs Nos. 3 and 4.

Surgical No. 2331. C. A., aet. 21 months. Very large, left inguinal hernia; reducible, complete, congenital, present since birth. Large, right inguinal hernia, reducible, complete, congenital, present since birth. Small umbilical hernia, present since birth. Congenital phimosis. First operation 14-8-'93, Finney. Left side, veins small, excised, wound closed with silk; sack very large, dissection difficult. Healing per primam; highest temperature 102°. A good deal of swelling of the testicle and epididymis followed operation. Second operation, right side, 23-9-'93, Finney. Veins small, excised, wound closed with silk. Sac large, contained cæcum and appendix; no adhesions. Healing, per primam; highest temperature 101.5°. A good deal of swelling of the testicle and induration of the epididymis followed operation. The umbilical hernia was operated on 2 weeks later (see Group IX, Case 2). Subsequent examinations, January 1895 and 1896, December 1896; examination June 1897, 4 years, wound solid, testicle normal, photograph No. 4. June 1898, examination, perfect result.

Case 59. Perfect result; last examination December 1895, 2 years 8 months; last report (letter) September 1897, 4 years 2 months.

Surgical No. 2332. C. A., aet. 47; clerk. Small, right inguinal hernia; reducible, incomplete, acquired, indirect, of 6 years' duration, of slow formation. Truss worn 4 years, which has not prevented the hernia from increasing in size. Patient complains of pains in the groin and in the back. Operation 8-7-'93, Finney. Sac very small and wall thin. Veins large, excised. Closed with silk. Healing p. p. Highest temperature 100.5°. No induration of epididymis followed operation. December 1895, 2 years and 5 months, returns to the hospital with malarial fever, wound solid, no atrophy of testicle, a perfect result. January 1896, letter, 3 years 6 months, well. September 1897, letter, 4 years 2 months, well, testicle normal.

Case 60. Perfect result; last examination May 1895, 1 year 8 months.

Surgical No. 2382. E. F., aet. 11. Small, left inguinal hernia; reducible, incomplete, congenital, associated with a small hydrocele of the cord in front of the wound, of 4 months' duration and rapid formation after heavy

lifting. Operation 3-8-'93. Finney. Sac small. Hydrocele excised. Veins excised. Healing p. p. Highest temperature 103°. No induration of epididymis followed operation. May 1895, examined, 1 year 8 months, perfect result, testicle normal. March 1897, patient lost track of.

Case 61. Perfect result; last examination September 1897, 3 years.

Surgical No. 2395. E. M., aet. 13; schoolboy. Small, right inguinal hernia; reducible, complete, congenital, of 1 year's duration, following heavy lifting. Operation 12-8-'93, Bloodgood. Sac small. Wall thin. Veins small, not excised. Healing p. p. Highest temperature 100°. No swelling of epididymis followed operation. Examination April 1894, 9 months, readmitted to hospital, having been kicked in the hernial wound by a horse; scar is 8 cm. long and 5 mm. wide, solid, no atrophy of testicle, a perfect result, patient remained in the hospital 3 weeks under observation. January 1896, letter, 2 years 4 months, well. September 1897, examination, 3 years, wound solid, external ring closed, testicle and epididymis normal.

Case 62. Patient lost track of since operation; epilepsy.

Surgical No. 2400. F. R., aet. 45; laborer. Small, right inguinal hernia; reducible, incomplete, acquired, indirect. Operation 17-8-'93, Finney. Sac small. A mass of properitoneal fat in front of sac and adherent to cord. Veins large, excised. Closed with silk. Healing p. p. Highest temperature 103° on the 3d day, lasting 2 days. No cause found. Patient an epileptic and had a number of fits after operation. Patient lost track of.

Case 63. Perfect result; last examination August 1897, 4 years. Hydrocele followed operation; veins excised.

Surgical No. 2447. C. L., aet. 26; driver. Medium, right inguinal hernia; reducible, complete, acquired, indirect, of 7 years' duration and slow formation. Truss worn but a short time, because it gave so much discomfort. Operation 1-9-'93, Finney. Veins excised. Closed with silk. Healing p. p. Highest temperature 100°. Induration of epididymis followed operation. Subsequent examinations, November 1893, 2 months, wound solid, but the epididymis is still indurated. November 1894, 1 year and 2 months, scar is a fine, red line; the wound is solid; induration of the epididymis has disappeared and there is present a small hydrocele. April 1895, 1 year and 2 months, well, no recurrence, hydrocele has not increased in size, no atrophy of testicle, a perfect result. February 1896, examined, 2 years 5 months, perfect result, testicle normal, hydrocele aspirated 6 months ago, has not returned. December 1896, examined, 3 years 2 months, perfect result, testicle normal, the hydrocele has returned, diameter about 2 cm., gives no discomfort. August 1897, examination, 4 years, perfect result, hydrocele a little larger.

Case 64. Perfect result; last report (letter) December 1894, 1 year 3 months.

Surgical No. 2448. W. A. T., aet. 25; farmer. Small, right inguinal hernia; reducible, incomplete, acquired, indirect, of 5 years' duration. Truss

worn 5 years. Complains of frequent micturition and pains in the right groin over the bladder. Operation 5-9-'93, Finney. Sac very small. Veins small, excised. A small hydrocele not excised. Abdominal wall is unusually thin. Closed with silk. Healing p. p. Highest temperature 100.5°. Some induration of epididymis followed operation. Subsequent reports by letter. December 1894, 1 year and 3 months, patient writes that he is perfectly well and that there is no recurrence of the hernia.

Case 65. Perfect result; last examination December 1898, 5 years 3 months.

Surgical No. 2459. W. J., aet. 4. Small, left inguinal hernia; reducible, incomplete, congenital, present since 2 weeks of age. Operation 14-9-'93, Finney. Sac small. Veins small, excised. Closed with silk. Healing p. p. Highest temperature 101°. Slight induration of epididymis followed operation. May 1894, examination, 9 months, wound solid, slightly hypertrophied in scar, induration of epididymis has disappeared, no atrophy of testicle, perfect result. January 1898 and December 1898, examination, 5 years 3 months, perfect result, wound solid, left testicle a little smaller than right.

Case 66. Perfect result: examination June 1898, 4 years 8 months; last report (from physician) October 1898, 5 years.

Surgical No. 2588. J. S., aet. 29; clerk. Medium, left inguinal hernia; reducible, complete, acquired, indirect, of 9 years' duration, of slow formation, following heavy lifting. A number of trusses have been worn, but they all have been of no value, and have given discomfort. Operation 31-10-'93, Halsted. Sac contains a small piece of adherent omentum, which was excised. Veins small, excised. Cord not transplanted as high as usual. Closed with silk. Healing p. p. Highest temperature 101.5°. Slight induration of epididymis followed operation. January 1895, 1 year and 10 months, patient writes that he is perfectly well, and that there is no atrophy of the testicle, and that he does heavy lifting. December 1895, 2 years and 1 month, patient writes that he is perfectly well. January 1896, letter, 2 years 3 months, well. August 1897, 3 years 10 months, physician reports perfect result, testicle normal. June 1898, examination, perfect result.

Case 67. Perfect result; last examination November 1898, 5 years. *Gold foil dressing, first case.*

Surgical No. 2602. W. M., aet. 37; clerk. Medium, left inguinal hernia; reducible, complete, acquired, indirect, of 27 years' duration. Truss not worn. Hernia has been small and given no discomfort until 10 weeks ago, since when it has increased rapidly in size and become painful. This change seems to have been brought about by a severe cough. Operation 7-11-'93, Halsted. Veins small, excised. Closed with silk. Dressed with *gold foil*. Healing p. p. Highest temperature 100.2°. Slight induration of the epididymis followed operation. Cultures taken from the skin beneath the gold foil on the 7th day showed a few colonies of *staph. pyog. albus*. January 1894, 2 months; induration of epididymis has disappeared, but

the stump of the ligated veins is still to be felt. November 1894, 1 year, examination, wound solid, stump of ligated veins can no longer be felt. There is no atrophy of testicle, perfect result. December 1895, 2 years and 1 month, examination, no recurrence, no atrophy of testicle. November 1896, 3 years, letter, well. May 1897, 3 years 6 months, examination, perfect result, no change in testicle, stump of ligated veins has disappeared. August 1897, 4 years, examination, perfect result. November 1897, 4 years 3 months, letter, perfect result. August and November, 1898, examinations, perfect result.

Case 68. Perfect result; last examination November 1897, 4 years.

Surgical No. 2636. D. T., æt. 31. Small, left inguinal hernia: reducible, incomplete, acquired, indirect, of 3 months' duration and slow formation, following heavy lifting. Truss not worn. Operation 23-11-'93. Halsted. Sac very small and thin. Veins small, excised. The abdominal wall very thin. Transplantation of the cord was difficult, due to adhesions of the cord to the neck of sac. Closed with silk. Healing p. p. Highest temperature 100.2°. No induration of epididymis followed operation. March 1894, 4 months, examination, wound solid, no atrophy of testicle, stump of ligated veins is still to be felt, but it is small and soft. a perfect result. August 1897, 3 years 10 months, examination, perfect result, testicle normal. November 1897, 4 years, examination, perfect result, wound solid, testicle normal.

Case 69. Perfect result; last examination August 1898, 4 years 8 months. Complete resolution after a very severe epididymitis.

Surgical No. 2635. J. D. G., æt. 5½ years. Medium, right inguinal hernia; reducible, complete, acquired, indirect, present since 1 month of age. Truss worn but a few days on account of discomfort and excoriation of skin. Operation 24-11-'93. Halsted. Veins excised. Closed with silk. Dressed with gold foil. Healing p. p. Highest temperature 100°. Much swelling of testicle and induration of the epididymis followed the operation. At the end of 3 weeks much of the swelling and the œdema of the scrotum had disappeared, leaving a pyriform mass extending from the testicle up into the groin. The base was formed by the epididymis and testicle, above which the vas deferens and veins were so matted together that the former could not be differentiated. There was some tenderness at first but none after a few days. October 1894, examined, 10 months: wound solid, external ring closed; the right testicle is a little larger than the left; the epididymis cannot be differentiated, but is still indurated; above the epididymis the vas deferens cannot be differentiated in the indurated mass of veins. December 1896, examined, 3 years, perfect result, wound solid, external ring closed, testicle and epididymis normal in size and consistency; the vas deferens and a few veins are distinctly felt extending up into the groin. Near the epididymis is a small mass about 5 mm. in diameter, the stump, no doubt, of the ligated veins. This case illustrates a perfect recovery after a very marked attack of epididymitis following operation. August 1897, examination, 3 years 8 months, result perfect, testicle normal. August 1898, examination, no change.

Case 70. Perfect result; last examination February 1894, 3 months.

Surgical No. 2655. N. B., æt. 17: schoolboy. Medium, left inguinal hernia; reducible, incomplete, acquired, indirect, of 1 year's duration and slow formation. Operation 29-11-'93, Halsted. Veins large, excised. Closed with silk. Dressed with gold foil. Healing p. p. except at the lower end of the skin incision, 5 mm. of which healed by granulation. Cultures from this portion under the gold foil gave a profuse growth of *staph. pyog. aureus*. No swelling of epididymis followed the operation. February 1894, 3 months, examination, no atrophy of testicle, a perfect result.

Case 71. Perfect result; last examination August 1893, 4 years and 8 months. Wound suppurated; three secondary stitch abscesses 1 to 8 months after operation.

Surgical No. 2689. E. L. B., æt. 30; laborer. Small, left inguinal hernia; reducible, incomplete, acquired, indirect. Hernia noticed first 1 month ago. Causes no discomfort. Operation 12-12-'93, Halsted. Sac very small. The femoral canal was also explored, but no hernia was found. Abdominal walls very thin. Wound closed with silk. As there was also a slight impulse on the right side, the wound of the former operation was explored. There was no evidence of a recurrence. Wound was closed with silk. Both sides healed p. p. 1 week after discharge a stitch abscess formed on the left side; subsequently, in the next 8 months, there were three stitch abscesses. October 1894, 11 months since operation on the left side, wound on the left side is solid, all the stitch sinuses have healed, 4 months. Right side, between the middle third of the scar and Poupart's ligament an opening can be felt in the aponeurosis of the external oblique muscle, in which there is a small irreducible mass. December 1896, condition of the patient remains the same, he suffers very little discomfort, and is able to work. (See Case 32, Surgical No. 1293.) Examination, January 1896, 2 years since operation on the left side; 4 years and 9 months since operation on the right side; the wound on the right side is solid; the small tumor between the lower third of the scar and Poupart's ligament is still present; it is not reducible, but feels like a mass of properitoneal fat, projecting through the split in Poupart's ligament; it does not grow larger and gives no discomfort, except when bladder becomes over-distended. The wound on the left side is solid; both external rings are closed; the right testicle is slightly larger than the left, the left being about normal in size; both right and left epididymis are soft; there is a large varicocele on the right side (the veins on this side were not excised); the varicocele present before operation on left side is cured; the result seems perfect; patient does hard work and lifting. December 1896, examination, 3 years, perfect result. March 1897, examination, 3 years 3 months, perfect result; patient's wife has given birth to healthy child; both cords were transplanted and the veins excised on the left side. August 1897, 3 years 8 months, examination, wound solid, perfect result; testicle normal. August 1898, examination, perfect result.

Case 72. Perfect result; last report (by physician) August 1898, 4 years and 8 months.

Surgical No. 2753. W. L. B., aet. 2 years and 7 months. Small, right inguinal hernia; reducible, incomplete, acquired, indirect, present since 2 months of age. Has always worn a truss. Operation 15-1-'94, Halsted. Sac very small. Veins small, excised. Closed with silk. Circumcision also performed. Healing p. p. Highest temperature 101°. No induration of epididymis followed operation. October 1894, 10 months, parents write that child is perfectly well and there is no atrophy of testicle. January 1896, letter, 2 years, well. November 1896, letter, 2 years 10 months, well. August 1898, 4 years 8 months, physician reports result perfect, testicle normal.

Case 73. Perfect result; last examination March 1899, 5 years and 2 months. Late suppuration of wound due to fat necrosis. Abscess in scrotum; single sinus from silk suture 6 months. Hydrocele followed operation; veins excised. Patient suffered from neuralgia in the groin for about 6 months after operation.

Surgical No. 2770. G. S. R., aet. 36, contractor. Large, right inguinal hernia; partially irreducible, complete, acquired, indirect, of 26 years' duration, following an injury. Has worn a truss, which, however, has not retained the hernia and has given a great deal of discomfort. Operation 20-1-'94. Halsted. Subcutaneous fat was very thick; sac large and contained very adherent omentum, which had become entirely shut off from the general peritoneal cavity. During the operation peritoneal cavity was not opened. Abdominal muscles were thin; conjoined tendon wide and firm; veins large, excised, wound closed with silk, dressed with copper foil. Patient made an uneventful convalescence. Highest temperature was, on the second day, 102°; between the 2d and 13th day, rectal temperature from 99.5 to 100.5. On the 13th day it rose to 103. On examining the wound it was found to be distended with fluid. A small opening was made, through which the fluid was evacuated. The material in the wound was composed chiefly of fat débris and many oily globules, a few red-blood cells and a great number of leucocytes. Cover-slips showed a few cocci free and in the leucocytes; cultures, a few colonies of the staphylococcus pyogenes aureus and albus. A few days later a few small masses of necrotic fat were discharged through the opening. On the 23d day a gravitation abscess was formed in the scrotum and was opened. Patient left the hospital in 6 weeks with a small sinus in the lower angle of the wound. The testicle was slightly enlarged and epididymis indurated. Beginning on the 20th day patient had a number of attacks of pain referred to groin and testicle. The sinus healed in 6 months. The attacks of pain gradually diminished in frequency and severity, and entirely disappeared within 6 and 8 months. December 1896, examined, 2 years and 4 months, wound is solid; right testicle is enlarged by a small hydrocele; epididymis is still indurated; testicle is not atrophied. October 1897, 3 years, patient writes that the wound is solid but that the hydrocele has increased somewhat in size.

Case 74. Perfect result; last examination September 1897, 3 years 7 months. *First case in which silver wire was used.*

Surgical No. 2777. D. R., æt. 10; schoolboy. Small, right inguinal hernia; reducible, complete, acquired, indirect, present since birth. Truss has been worn 2 years. Operation 6-2-94, Halsted. The sac was very small, and was not opened. Veins small, excised. The wound was closed with buried mattress sutures of silver wire; this was the first case in which a silver wire was used. Healing p. p. Temperature 103° on the 5th day, due to acute otitis media, which was completely relieved by paracentesis. Some induration of epididymis and œdema of scrotum followed operation. January 1895, scar a narrow red line; wound solid; the stump of the ligated veins still to be felt near the epididymis; no atrophy of testicle. May 1895, 1 year and 5 months, wound solid; stump of ligated veins still to be felt, but small; testicle normal, a perfect result. October 1896, examined, 2 years 10 months, perfect result; testicle normal. September 1897, examined, 3 years 7 months, scar mass in white line; wound solid; suture not palpable; testicle normal.

Case 75. Perfect result; last examination September 1897, 3 years and 7 months since operation. Last report (by physician) January 1899, 4 years and 11 months.

Surgical No. 2801. S. D., æt. 6. Small, right inguinal hernia; reducible, complete, acquired, indirect, of a few months' duration. The patient was operated on for left inguinal hernia in June 1893 (see Case 56, Surgical No. 2294). Operation 12-2-94, Halsted. Sac very small, not opened. Veins small, excised. Closed with silver wire; dressed with silver foil. Healing p. p. Temperature 101°. Slight induration of epididymis and œdema of scrotum followed operation. October 1894, 1 year and 4 months since first operation and 8 months since second operation, parents write that the child is perfectly well; there is no recurrence; no atrophy of testicle; a perfect result. January 1896, letter, 2 years, well. September 1897, examination, 3 years 7 months, wound solid; external ring closed; testicle normal.

Case 76. Perfect result; last examination September 1897, 3 years 7 months; last report (by letter) September 1898, 4 years 7 months. Hydrocele followed operation; congenital hernia; sac sutured.

Surgical No. 2802. D. W. G., æt. 22; student. Small, left inguinal hernia; reducible, incomplete, congenital, present since 10 years of age. Has always worn a truss. 3 weeks ago the hernia slipped past the truss and became strangulated, but was reduced under chloroform. Operation 7-2-94, Halsted. Sac very small. Veins small, excised. Closed with silk. Healing p. p. Temperature 100°. Slight induration of epididymis followed operation. December 1895, 1 year and 10 months, well; no recurrence; no atrophy of testicle; there is a small hydrocele near the epididymis. December 1896, examined, 1 year 10 months, perfect result;

testicle normal; hydrocele no larger. May 1897, 2 years 3 months, letter, well. September 1897, examined, 2 years 7 months, perfect result; hydrocele no larger. Letter, September 1898, 3 years 7 months, well; hydrocele larger.

Case 77. Perfect result; last examination August 1897, 3 years 6 months; last report (letter) October 1898, 4 years 8 months. Hydrocele followed operation; veins excised.

Surgical No. 2842. B. H., aet. 14; schoolboy. Small, right inguinal hernia; reducible, complete, acquired, indirect, of 10 days' duration, following injury. Operation 6-3-'94, Bloodgood. The sac was thick-walled and quite adherent, as if it had been present a much longer time than the rupture had been noticed. Veins large, excised. Closed with silver wire. Healing p. p. Temperature 99°. Slight induration of epididymis and oedema of scrotum followed operation. April 1894, 2 months, examination, scar hypertrophied; wound solid; induration of epididymis has disappeared and only the stump of the ligated veins can be felt. No atrophy of testicle; a perfect result. January 1897, letter, 2 years 10 months, well; small hydrocele. March 1897, letter, 3 years, well; hydrocele no larger. June 1897, examination, wound solid; external ring closed; sac of hydrocele excised under ether; testicle and epididymis normal. Perfect result, 3 years 4 months. August 1897, letter, well; testicle normal, 3 years 6 months. October 1898, letter, wound solid; right testicle normal; varicocele on left side.

Case 78. Perfect result; last examination December 1895, 1 year 9 months; last report (letter) February 1897, 3 years. Hydrocele followed operation; veins excised.

Surgical No. 2862. M. P., aet. 28; salesman. Medium, right inguinal hernia; reducible, complete, acquired, indirect. Operation 6-3-'94. Halsted. Veins large, excised. Muscle quite thin. Wound closed with silver wire and irrigated with 1 to 1000 bichloride. Healing p. p. Temperature 100°. Slight induration of epididymis followed operation. October 1894, 7 months, well; induration of epididymis has almost disappeared. January 1895, letter, perfectly well; no atrophy of testicle. Before the operation for hernia the patient was operated on for suppurating glands in both groins, following gonorrhœa. The glands were extensively involved, and their excision was complete. Following the hernia operation there was some swelling of the testicle and induration of the epididymis. December 1895, re-admitted, 1 year 9 months after the operation, with the following condition: The skin of the penis and scrotum is much thickened; the skin of the penis is thrown into circular folds; the scrotum extends 6 cm. lower than normal; the skin pits on pressure, and a clear serum exudes and can be expressed on pressure; the scrotum is the seat of an eczema, the condition is the same on both sides; the right testicle is enlarged by a hydrocele; the swelling of the penis began about 1 year ago, the scrotum 3 months ago; the eczema has been present about 2 months. Micturition is somewhat painful, and the stream comes slowly and with difficulty. February 1897, letter, 3 years, perfect

result; testicle normal; hydrocele no larger; eczema well; swelling and oedema of penis and scrotum has disappeared.

Case 79. Perfect result; last report (letter) September 1898, 4 years 6 months.

Surgical No. 2867. C. L. B., aet. 24; farmer. Medium, right inguinal hernia; reducible, complete, acquired, indirect, of 2 years' duration, following heavy lifting. Has worn a truss. Operation 8-3-'94, Halsted. Veins large, excised. Closed with silver wire. Healing p. p. Temperature 100.5°. Scarcely any induration of epididymis followed operation. November 1894, 7 months, patient writes that he is perfectly well, but there is yet a little induration of epididymis, which gives no discomfort. January 1896, letter, 1 year 9 months, well; epididymis still indurated. April 1897, letter, 3 years, well; epididymis still indurated.

Case 80. Perfect result; last examination August 1898, 4 years 6 months.

Surgical No. 2880. C. L., aet. 6. Medium, right inguinal hernia; reducible, complete, acquired, indirect, of 4 years' duration. Operation 27-3-'94, Finney. Veins large, excised. Sac very adherent, making dissection difficult. Tunica vaginalis of the testicle was opened during the operation and was sutured. Wound closed with silk. Healing p. p. Highest temperature 99°. Only a slight induration of the epididymis followed operation. September and December 1894, examination, wound solid; induration of epididymis had disappeared; small stump of ligated veins still present; no atrophy of testicle. January 1896, examined, 1 year 9 months, perfect result; testicle normal; the stump of the ligated vein is still palpable but much smaller. December 1896, examined, 2 years 8 months, perfect result; testicle normal; stump of ligated veins not palpable; external ring closed. September 1897, 3 years 6 months, examined, perfect result. August 1898, examined, perfect result.

Case 81. Patient lost track of since operation.

Surgical No. 2828. C. H., aet. 28; painter. Medium, right inguinal hernia; reducible, complete, acquired, indirect, of 26 years' duration. Became irreducible for a few months 2 years ago. Truss of no value. Operation 20-2-'94, Halsted. Sac very adherent. Contents, adherent omentum, which was excised. Veins large, excised. Closed with silver wire; dressed with silver foil. Healing p. p. Temperature 101°. No induration of epididymis followed operation. Only the stump of the ligated veins can be felt. November 1896, lost track of.

Case 82. Perfect result; last report (letter) October 1895, 1 year 7 months, death.

Surgical No. 2920. T. B., aet. 45; carpenter. Large, right inguinal hernia; reducible, complete, acquired, indirect, of 6 years' duration; also a very small, left inguinal hernia. Operation 29-3-'94, Finney. Sac very adherent, in front of which there was a mass of properitoneal fat, which

was excised. Veins large, excised. Closed with buried silk and silver wire in skin. Healing p. p. Temperature 99.5°. June 1894, 2 months, induration of epididymis has disappeared. Stump of the ligated veins only to be felt. October 1894, patient writes that he is perfectly well. October 1895, patient died, 1 year 7 months, no recurrence, testicle normal; cause, some form of chronic constriction, lasting almost one year; no autopsy.

Case 83. Perfect result; last examination February 1896, 2 years; last report (by physician) November 1897, 3 years 8 months. Small hydrocele present before operation, increased after; veins excised.

Surgical No. 2928. R. H. C., aet. 23; clerk. Medium, right inguinal hernia; reducible, complete, acquired, indirect, of 2 years' duration, following a strain. Has worn a truss. Operation 30-3-'94, Finney. Sac contains a piece of adherent omentum, which was excised. Veins small, excised. Closed with silk sutures. Healing p. p. Temperature 100°. No induration of epididymis followed operation. January 1894, examination, wound solid, no induration of epididymis, stump of ligated veins not to be felt, no atrophy of testicle, small hydrocele of the right testicle, which was present before operation, a perfect result. February 1896, examination, 2 years, wound solid, hydrocele larger, sac of hydrocele excised under ether through incision in scrotum, testicle and epididymis carefully examined, normal. September 1897, 3 years and 6 months, letter, wound solid, testicle normal, no return of hydrocele. November 1897, 3 years 8 months, physician reports a perfect result and no return of the hydrocele.

Case 84. Perfect result; last examination January 1895, 9 months.

Surgical No. 2931. W. McC., aet. 2 years and 4 months. Small, right inguinal hernia; reducible, complete, acquired, indirect, of 8 months' duration and slow formation. Truss of no value. Operation 5-4-'94, Finney. Sac large, but walls very thin. The ring is large, admits 2 fingers. Veins not very large, excised. The vas deferens was accidentally clamped during the operation, but did not seem to be completely crushed. Wound closed with buried silk and silver wire in the skin. Circumcision also performed. Healing p. p. Highest temperature 100°. On the 17th day the child was attacked with chicken-pox, 2 days later with erysipelas, beginning in the marks of the left thigh. The erysipelas extended almost to the healed wound. On the 10th day a stitch abscess formed in the wound, which was opened and healed by granulation. No induration of epididymis followed operation. January 1895, 9 months, examination, wound solid, no induration of epididymis, stump of ligated veins not to be felt, no atrophy of testicle, a perfect result. March 1897, lost track of.

Case 85. Patient lost track of since operation.

Surgical No. 2990. G. H., aet. 25; farmer. Medium, right inguinal hernia; reducible, complete, acquired, indirect, present since childhood. Truss of no value. The hernia has become irreducible 3 or 4 times, remaining

so for 3 or 4 hours. Does not give much discomfort. Operation 184-94, Finney. The sac was not opened. Veins large, excised. The tissue included in the buried sutures was very thin. Closed with silk. Healing p. p. Highest temperature 101°. Very little induration of the epididymis followed operation (although in this case very few vessels were left with the vas deferens). January 1896, September 1897, lost track of.

Case 86. Perfect result; last examination September 1898, 4 years 5 months.

Surgical No. 3021. R. W. G., aet. 22; student. Small, right inguinal hernia; reducible, incomplete, acquired, indirect. Operation 24-4-94, Finney. The sac contains a small piece of adherent omentum, which was excised. Veins large, excised. Wound closed with silk. Healing p. p. Highest temperature 100.5°. Very little induration of epididymis followed operation. December 1894, 8 months, examination, wound solid, epididymis and testicle normal, stump of ligated veins smaller. December 1895, 1 year and 8 months, letter, patient perfectly well, no atrophy of testicle, a perfect result. November 1896, 2 years 7 months, letter, well. September 1897 and 1898, examination, 3 years 5 months, perfect result, testicle normal.

Case 87. Perfect result; last examination July 1896, 2 years 2 months; last report (letter) September 1898, 4 years 4 months.

Surgical No. 3110. L. T. P., aet. 16; schoolboy. Small, right inguinal hernia; reducible, incomplete, acquired, indirect, associated with a small hydrocele, present since 1 year of age. Has worn a truss, except for an interval of 3 months when 6 years of age, when it was removed in hopes that a cure had been made, but the hernia returned. No inconvenience from hernia or truss. Operation 31-5-94, Halsted. Sac very small and not adherent. Part of the sac of the hydrocele excised; remainder touched with pure carbolic. Veins large, excised. Closed with silver wire. Healing p. p. Highest temperature 100°. Much swelling and oedema of serotum and induration of epididymis followed operation. On the 20th day a small haematocele, containing 10 cc. of bloody serum, was aspirated. It was situated in the position of the hydrocele. October 1894, letter, no return, a small hydrocele still present. April 1895, 1 year later, well, hydrocele still present, otherwise a perfect result. January 1896, 1 year 9 months, letter, well, hydrocele still present, no larger. July 1896, 2 years 2 months, admitted to hospital and operated on for hydrocele, incision through scrotum, wall of hydrocele thin, about 3 x 4 cm. in diameter, no evidence of any inflammation, testicle and epididymis normal, stump of ligated veins a small mass of connective tissue about 5 cm. in diameter, healing p. p. September 1898, 4 years 4 months, letter, perfect result, testicle normal.

Case 88-89. Perfect result; last examination September 1897, 3 years 4 months.

Surgical No. 3119. J. F., aet. 10; schoolboy. Large, right inguinal hernia; reducible, complete, acquired, indirect, present since birth. The

right testicle is one-third smaller than the left. Operation 31-5-'94, Halsted. Sac very large, but wall thin. Ring admits 2 fingers. Veins small, excised. Muscle quite thin. Cord not transplanted as high as usual, because when so transplanted the testicle was drawn out of the scrotum. Closed with silver wire. Healing p. p. Highest temperature 99.5°. Some induration of epididymis followed operation, which disappeared in 48 hours, leaving only the stump of the ligated veins to be felt.

Surgical No. 3119. J. F., æt. 10. Small, left inguinal hernia; reducible, incomplete, of the encysted, infantile variety, noticed 2 days after the patient got out of bed, following recovery from the operation on the right side. Operation 23-6-'94, Parsons. Sac small and wall very thin. Veins not excised. Wound closed with silver wire. As the testicle had a tendency to retract up into the abdomen, it was sutured to the scrotum. The method of suture was as follows: The lower portion of the scrotum was invaginated with the index finger, so that from the abdominal wound a suture could be easily passed which included the dartos. This suture was also passed through the outer tunics of the testicle and tied, so that when the scrotum was replaced the testicle was drawn down and held firmly in place. Healing p. p. Highest temperature 100°. No induration of epididymis followed operation. March 1896, 1 year 9 months, examination, perfect result, testicles normal, external ring closed, stump of ligated veins palpable. December 1896, 2 years 5 months, examination, perfect result, testicles normal. September 1897, 3 years 4 months, examination, wounds solid, testicles normal, one silver wire palpable.

*June 1894 to June 1895.*

Case 90. Patient lost track of since operation.

Surgical No. 3170. A. D., æt. 40; laborer. Small, right inguinal hernia; reducible, incomplete, acquired, indirect, of 3 months' duration, following lifting. Has worn a truss. Operation 19-6-'94, Bloodgood. Sac and ring very small. Veins small, excised. Closed with silver wire. Healing p. p. Highest temperature 99.5°. November 1896, patient lost track of.

Case 91. Perfect result; last examination August 1897, 3 years 2 months.

Surgical No. 3182. R. L., æt. 32; engineer. Small, right inguinal hernia; reducible, complete, acquired, indirect, of 8 years' duration. Has worn a truss and also has had 8 injections into the groin, first 8 months ago, last 2 months ago. There is present in the groin a good deal of scar tissue, following the injections, but there has been no result towards the cure of the hernia. Operation 25-6-'94, Halsted. Sac small. Veins small, excised. About the sac and cord there is a good deal of new connective tissue, matting the tissues together and making a dissection more difficult. Closed with silver wire. Healing p. p. Highest temperature 99.5°. Very little induration of epididymis followed operation. Has been examined frequently since the operation. The stump of the ligated veins became absorbed in about 6 months. March 1895, 9 months, examination, wound solid, no atrophy of testicle, a perfect result. February 1896, 1 year 8 months, examination, perfect result, testicle normal. August 1897, 3 years 2 months, examination, perfect result, testicle normal.

Case 92. Patient lost track of since operation.

Surgical No. 3192. J. D., æt. 40; laborer. Medium, left inguinal hernia; irreducible, complete, acquired, indirect, of 16 years' duration and gradual formation. Has worn a truss. Herniotomy was performed 4 years ago for strangulation. Has been under treatment by injection for 5 weeks in the last 2 months with no result. Operation 27-6-'94, Finney; ether. Sac was small. Walls thin and contained a small piece of very adherent omentum, which was excised. The tissues outside the sac were matted together by new connective tissue, making a dissection very difficult. Veins large, excised. Wound closed with silk. In 24 hours temperature was 103° and there was much pain complained of in the wound. The skin incision only was opened and the wound irrigated. Temperature soon fell and the wound rapidly healed by granulation. None of the buried sutures came away. Cultures taken from the blood of the wound showed that the infection was due to the staph. pyog. aureus. Patient discharged well in 6 weeks. November 1896, patient lost track of.

Case 93. Perfect result; last examination August 1898, 4 years. Very large hernia; haematoma in scrotum; atrophy of testicle. Veins excised.

Surgical No. 3239. C. S., æt. 37; German. Very large, right inguinal hernia; reducible, complete, acquired, indirect, of 3 months' duration, of rapid formation, following a fall. Operation 14-7-'94, Finney. Sac very large. Walls thin and very adherent to the surrounding tissues. Sac contained a large mass of omentum, which was not adherent but which was excised, because of the impossibility of effecting a reduction without greatly enlarging the abdominal ring. Veins large, excised. Wound closed with silk. Healing p. p. Highest temperature 103°. On the 15th day a large haematoma, which formed in the scrotum, was opened. This healed rapidly by granulation, but before it had entirely closed the lower silk sutures of the abdominal wound were discharged through the sinus in the scrotum. Patient discharged in 4 weeks with a small sinus at the junction between the abdomen and scrotum. October 1894, 6 months, examination, the wound is solid, the sinus is still present, the testicle is distinctly atrophied and drawn up into the scrotum. The cure of the hernia seems perfect. April 1897, 2 years 9 months, examination, perfect result, left testicle atrophied and retracted, patient healthy and works hard. August 1898, examination, perfect result, 4 years.

Case 94-95. Perfect result, left side. Partial recurrence in lower angle on right side. Last examination August 1898, 4 years. Both wounds suppurated; veins excised; atrophy left testicle; hydrocele right testicle.

Surgical No. 3265. J. K., æt. 34; laborer. Small, right and left inguinal herniae; reducible, incomplete, acquired, indirect, of 1½ years' duration, right hernia appearing first; give very little discomfort. Operation 27-6-'94, Finney, on both sides. Sacs very small, not opened. Veins large, excised. Closed with silk. On both sides the muscle was very thin. At

the end of 24 hours temperature was 103.2° and a good deal of pain was referred to the wounds. The skin incisions only were opened and the wounds irrigated. Temperature fell to normal in 12 hours and the wounds healed rapidly by granulation. Patient discharged in 6 weeks, both wounds having healed solidly and none of the buried sutures having come away. Very little induration of epididymis followed operation. Cultures from the blood in the wounds showed the infection to have been due to the staph. pyog. albus and aureus. February 1895, 7 months, examination, both wounds solid; scars are elevated, red ridges, 10 cm. long and 5 to 8 mm. wide, differing very little from wounds which have healed p. p.; patient thinks the left testicle is smaller than before the operation; there is a small hydrocele present on the right side, otherwise a perfect result; the patient states that the operation has given him great relief and that he is able to do heavier work and lifting. January 1897, 2 years 6 months, both wounds solid, left testicle atrophied and drawn up to pubes, hydrocele on right side preventing palpation of testicle and epididymis. August 1897, examination, 3 years 2 months, both wounds solid, left testicle no smaller; hydrocele fluid, right testicle aspirated, testicle normal, epididymis indurated. August 1898, examination, 4 years 2 months, no change except a partial recurrence on the right side. There is a small bulging and impulse at the external ring and the index finger finds a small opening at the outer border of the rectus muscle. The opening is in the conjoined tendon. This condition had not been noticed by the patient.

Case 96. Perfect result; last examination June 1897, 2 years 10 months; last report (letter) August 1898, 4 years. Operation for hernia preliminary to plastic for complete extroversion of bladder.

Surgical No. 3285. M. L. S., aet. 36; farmer. Large, left inguinal hernia; reducible, complete, acquired, indirect, present since birth. There was also present a complete extroversion of the bladder. Operation 7-8-'94, Finney. Sac small and wall thin. No adhesions. Veins small, excised. Wound closed with silk. Healing p. p. Highest temperature 101°. After the operation patient was kept on his right side for 3 weeks, thus preventing contamination by urine. December 1895, 1 year and 5 months, examination, a perfect result, no atrophy of testicle. April 1896, 1 year 8 months, examination, perfect result, testicle normal. December 1896, 2 years 4 months, examination, perfect result, testicle normal. June 1897, 2 years 10 months, examination, perfect result, testicle normal. August 1898, 4 years, letter, well.

Case 97. Perfect result; last examination May 1897, 2 years 10 months; last report (physician) September 1898, 4 years.

Surgical No. 3298. E. M., aet. 16; schoolboy. Large, left inguinal hernia; reducible, complete, congenital, present since birth. Has not worn a truss except for 1 week, when it gave so much pain and discomfort that it was discontinued. Operation 1-8-'94, Finney. Sac small. Tunica vaginalis sutured over testicle. Veins excised. Walls thin. Wound closed

with silk. Healing p. p. Highest temperature 100.5°. Much swelling of scrotum and epididymis followed operation. Much epigastric distention, requiring the Pacqueline. October 1894, 2 months, examination, wound solid, no atrophy of testicle. There is a small hernia beginning on the other side. May 1897, 2 years 10 months, examination, well. September 1898, 4 years 1 month, letter from physician, perfect result.

Case 98. Perfect result; last examination October 1895, 1 year 2 months; last report (letter) August 1898, 4 years.

Surgical No. 3323. C. W., aet. 26; farmer. Small, right inguinal hernia; reducible, incomplete, acquired, indirect, present since birth. Has been strangulated 4 times, but reduced without operation. Wears a truss. Operation 18-8-'94, Finney. Sac small. Veins small, excised. Wound closed with silk. Healing p. p. Highest temperature 100.5°. December 1894, examination, wound solid, no atrophy of testicle, a perfect result. October 1895, 1 year 2 months, examination, perfect result, testicle normal. August 1898, letter, well, 4 years.

Case 99. Perfect result; last examination August 1897, 3 years.

Surgical No. 3449. C. S. S., aet. 42; laborer. Large, left inguinal hernia; strangulated 4 days, complete, acquired, indirect. Has worn a truss. Has had a number of attacks in which the hernia has become irreducible. Operation 29-9-'94, Bloodgood. Sac has an hour-glass constriction, strangulating a mass of omentum, which was easily reduced after dividing constriction. Besides omentum the sac contained a good deal of clear fluid, cultures from which were negative. The abdominal muscle and fascia were very thin. Wound was irrigated with 1 to 1000 bichloride. Closed with silver wire. Dressed with silver foil. Healing p. p. Highest temperature 104°. Cause, acute bronchitis. Very little swelling of epididymis followed operation. April 1895, 7 months, examination, wound solid, induration of epididymis has disappeared, no atrophy of testicle, a perfect result. December 1895, 1 year 3 months, letter, well, works hard. December 1896, 2 years 3 months, letter, well. August 1897, 3 years, examination, wound solid, external ring closed, testicle normal, perfect result.

Case 100. Perfect result; last examination September 1897, 3 years. Complete atrophy of the testicle; veins excised; haematoma in scrotum.

Surgical No. 3478. W. K., aet. 7; schoolboy. Large, right inguinal hernia; reducible, complete, acquired, indirect, present since birth. Operation 12-10-'94, Halsted. Sac large, wall thin. Veins large, excised. Ring admits the index finger. There were many adhesions about the sac. Wound closed with silver wire. Dressed with silver foil. Healing p. p. Highest temperature 104° on the 4th day, lasting 6 hours, due probably to absorption from a large haematocoele of the scrotum, which followed operation. Swelling of the scrotum appeared immediately after operation and in 6 hours the scrotum was distended and tense. At the end of 3 weeks all had been absorbed except the slightly indurated epididymis.

April 1895, 6 months, examination, wound solid, epididymis a little indurated, stump of ligated veins to be felt, no atrophy of testicle, perfect result. January 1896, 1 year 3 months, examination, perfect result, testicle normal, epididymis still indurated. November 1896, 2 years 1 month, examination, perfect result, testicle one-third smaller, epididymis indurated (atrophy of the testicle without a doubt). February 1897, 2 years 4 months, examination, wound solid, complete atrophy of testicle. September 1897, examination, 3 years, wound solid, silver sutures not palpable. Nothing to be felt in the right side of the scrotum but a small nodule 5 mm. in diameter.

Case 101. Perfect result; last report (by physician) September 1897, 3 years.

Surgical No. 3533. W. R. H., æt. 30; photographer. Small, right inguinal hernia; reducible, complete, acquired, indirect, of 18 years' duration. Truss worn for the last 18 years and gives much discomfort. Operation 1-11-'94, Halsted. Sac large, walls thin. No adhesions except between the cord and sac. Veins large, excised. Wound was irrigated with 1 to 1000 bichloride. Closed with silver wire. Healing p. p. Highest temperature 99.5°. Very little induration of epididymis follows operation. April 1895, letter, patient writes that he is perfectly well. December 1895, 1 year, letter, patient writes that he is able to work harder than he has done before for 10 years, and that the hernia has not recurred. November 1896, 2 years, letter, well. September 1897, 3 years, physician reports that the wound is solid and the testicle normal.

Case 102. Perfect result; last examination April 1895, 5 months.

Surgical No. 3543. J. S., æt. 24; laborer. Small, left inguinal hernia; reducible, incomplete, acquired, indirect, of 2 months' duration, of rapid formation, following injury. Operation 16-11-'94, Halsted. Sac small. Ring admits 2 fingers. Veins small, excised. Wound was irrigated with 1 to 1000 bichloride. Closed with silver wire. Dressed with silver foil. Healing p. p. Highest temperature 101.2°. A little edema of scrotum and marked induration of epididymis followed operation. A mild attack of bronchitis followed operation. April 1895, 5 months, examination, wound solid; the epididymis and cord are still indurated but not tender; there is a distinct atrophy (beginning on the left side) of testicle; patient had a small, right inguinal hernia, operation not advised. November 1896, lost track of.

Case 103. Perfect result; last examination August 1898, 3 years 8 months.

Surgical No. 3588. J. C. R., æt. 24; conductor. Small, left inguinal hernia; reducible, complete, acquired, indirect, of 1 year's duration and slow formation. Truss not worn. Operation 14-11-'94, Bloodgood. Sac small, walls thin. Veins small, excised. Muscle thick. Wound closed with silver

wire. Healing p. p. Highest temperature 100°. Only a slight induration of epididymis followed operation, confined chiefly to the stump of ligated veins. March 1895, 4 months, examination, wound solid, no atrophy of testicle, induration of epididymis has disappeared, stump of ligated veins not to be felt. January 1896, 1 year 2 months, examination, perfect result, testicle normal. December 1896, 2 years, letter, well. February 1, 1897, 2 years 2 months, examination, perfect result, testicle normal. August 1898, examination, 3 years 8 months, perfect result.

Case 104. Perfect result; last examination September 1898, 3 years 10 months. Testicle smaller; atrophy a question; veins excised.

Surgical No. 3597. A. K., aet. 45; carpenter. Large, right inguinal hernia; strangulated 12 hours before admission, complete, acquired, indirect, of 20 years' duration. Has worn a truss with comfort. No history of strangulation until the present one. Condition good. Some nausea. No abdominal distention or tenderness. Operation 15-11-'94. Halsted. Sac large. Veins excised. Walls thick. Constriction in the sac near the internal ring. The sac was empty, intestine returning during the operation. Some clear fluid escaped from the abdomen. Wound closed with silver wire and irrigated with 1 to 1000 bichloride. Healing p. p. Highest temperature 101.2°. Very little induration of epididymis followed operation. April 1895, 5 months, examination, wound solid, no atrophy of testicle, stump of the ligated veins about 5 mm. in diameter, a perfect result. The induration of epididymis lasted six months. November 1896, examination, 2 years, perfect result, right testicle smaller than left, the same size (the patient states) as before operation; globus major nodular. March 1897, examination, perfect result. August 1897, examination, 2 years 9 months, perfect result, no further change in testicle, patient married and has two children. September 1898, examination, no change, 3 years 10 months.

Case 105. Perfect result; last examination January 1898, 3 years 2 months. Atrophy of testicle; veins excised.

Surgical No. 3621. S. H., aet. 25; sailor. Small, right inguinal hernia; reducible, complete, acquired, indirect, of 12 years' duration, following heavy lifting. Has worn a truss. Rupture prevents him from working. Operation 23-11-'94, Halsted. Sac small, walls thick. Veins large, excised. Muscle thick. Healing p. p. Highest temperature 101.8°. A good deal of induration of epididymis and stump of ligated veins followed operation. April 1895, 5 months, examination, wound solid, epididymis and stump of ligated veins form a hard, indurated mass, the testicle is slightly atrophied. December 1896, examination, 2 years, wound solid, testicle atrophied, induration has disappeared. March 1897, examination, 2 years 3 months, wound solid, *patient married, one child*. September 1897, examination, 2 years 10 months, perfect result, no further changes in testicle. January 1898, examination, 3 years 2 months, wound solid, silver suture not palpable.

Case 106. Perfect result; last report (by physician) September 1898, 3 years 9 months; last examination October 1895, 10 months after operation.

Surgical No. 3666. J. H., aet. 21; laborer. Small, right inguinal hernia; reducible, complete, infantile, of 3 years' duration and slow formation. Hernia comes down at intervals. On admission to the hospital no evidence of hernia could be found. The ring was slightly larger than the opposite. The operation was performed at the urgent request of the patient, who said that the hernia, when it came down, gave him a great deal of trouble. Operation 11-12-'94. Halsted. Sac was very small and thick and quite adherent to the cord, and of the infantile form. It contained omentum, which was very adherent to the neck of the sac, the neck of the sac being 2 cm. in diameter. There was a second constriction in the sac about its middle. Veins were small and excised. The abdominal muscle was thick. Wound closed with silver wire, and irrigated with 1 to 1000 bichloride. Healing p. p. Highest temperature 102°. Slight induration of epididymis followed operation. October 1895, 10 months, examination, wound solid, no atrophy of testicle. Induration of epididymis has disappeared, stump of ligated veins could not be felt. a perfect result. January 1896, December 1896. February 1897, letters, perfect result. August 1897, 2 years 8 months, report from physician, perfect result, testicle normal. September 1898, letter, well.

Case 107. Perfect result; last report (letter) August 1897, 2 years 8 months. Recurrent hernia; much scar tissue; suppuration; silver wire sinus.

Surgical No. 3676. H. B., aet. 38; engineer. Medium, right inguinal hernia; reducible, incomplete, acquired, indirect, hydrocele, recurring 3 years after operation, of 10 years' duration. 5 years ago it was operated on at another hospital, and he remained well for 3 years. The recurrence followed after a strain. Operation 18-12-'94. Bloodgood. The subcutaneous fat was very thick and there was a great deal of scar tissue about the sac. The sac was large, walls thick, containing a good deal of fluid. The sac was very adherent to the cord and veins and muscle. Veins small, excised. On account of adhesions the cord could not be transplanted as high as usual. Wound closed with silver wire and irrigated with 1 to 1000 bichloride. The wound opened on the 8th day for suppuration. It was not an acute affection, but was due probably to strangulated fat and scar tissue. Highest temperature 103°, which did not occur until the 8th day. An opening of only 2 cm. was made in the wound, through which the purulent material was evacuated. The wound was irrigated, so that in a few days it was entirely healed except a small sinus, which led to a deep stitch of silver, which came away the 4th week. On discharge the wound was solid except 1 small sinus. No atrophy of testicle. Hydrocele not operated on. May 1895, 5 months, admitted to Pennsylvania Hospital, Philadelphia, the sinus was excised and one silver suture removed and the sac of the hydrocele was also excised. Prof. John Ashurst, Jr., kindly sent us the notes of the case. There was no evidence of a recurrence of the hernia. November 1896, 2 years, letter; August 1897, 2 years 8 months, letter, the patient writes that the result is a perfect one, and that the testicle is normal.

Case 108. Perfect result; last examination September 1898, 3 years 8 months. Hydrocele followed operation; veins excised.

Surgical No. 3788. J. F. B., aet. 38; laborer. Small, right inguinal hernia; reducible, incomplete, acquired, indirect, of 3 months' duration, following heavy lifting. Has worn a truss. Operation 26-1-'95, Halsted. Sac small, wall thick. Contained omentum, which was not adherent. Veins small, excised. The deep epigastric artery was injured during the operation and ligated. Wound closed with silver wire and irrigated with 1 to 1000 bichloride. Healing p. p. Highest temperature 101.5°. Very little induration of epididymis followed operation. June 1895, 6 months, examination, wound solid, no atrophy of testicle. The stump of ligated veins is just palpable. Patient works hard and does heavy lifting. A perfect result. March 1896, 1 year 2 months, perfect result, stump of ligated veins still palpable but much smaller, testicle normal. December 1896, 1 year 11 months, letter, well. February 1897, 2 years, letter, well. September 1897, examination, 2 years 8 months, wound solid, external ring closed, sutures not palpable, small hydrocele, testicle and epididymis normal, stump of ligated veins not palpable. September 1898, examination, no change.

Case 109. Perfect result; last examination September 1898, 3 years 7 months. Before operation the right testicle was retracted and at intervals retracted up into the groin; after operation this retraction had not completely disappeared.

Surgical No. 3802. H. L., aet. 23; upholsterer. Small, right inguinal hernia; reducible, incomplete, acquired, indirect, of 12 years' duration, following strain. Of slow formation. Has worn a truss 4 years, which retained the hernia until 1 year ago. The second truss is not satisfactory and gives great discomfort. 2 weeks ago the hernia became irreducible for a few hours. Operation 5-2-'95, Parsons. Sac very small, wall thick. Many adhesions between the cord and sac. Veins small, excised. Muscle thick. Wound closed with silver wire. Healing p. p. Highest temperature 100.5°. Some induration of epididymis and ecchymosis of scrotum followed operation. June 1895, 5 months, examination, wound solid, no atrophy of testicle, stump of ligated veins to be felt, a perfect result. January 1896, 11 months, letter, well. April 1896, 1 year 2 months, examination, perfect result, testicle normal. April 1897, 2 years 2 months, letter, well. September 1897, examination, 2 years 7 months, wound solid, right testicle normal; this testicle hangs higher than the left and sometimes retracts up into the groin. September 1898, examination, wound solid, retraction of testicle; it gives no discomfort.

Case 110. Perfect result; last examination January 1897, 2 years; last report (letter) December 1898, 3 years 11 months. Atrophy of testicle; veins excised.

Surgical No. 3836. J. W. E., aet. 22; farmer. Small, right inguinal hernia; reducible, complete, acquired, indirect, of 12 years' duration, follow-

ing horse-back riding. Has worn a truss for 6 years, which has not given perfect satisfaction. Has had 26 injections, the last being 6 months ago, with no improvement. On examination, although hernia is on the right side, the external ring is smaller and the pillars of the ring appear to be thickened. Operation 30-1-95, Halsted. Sac very small. Veins small, excised. Muscle thick. Wound closed with silver wire and irrigated with 1 to 1000 bichloride. There was only a very little new connective tissue, the result of the injections. Healing p. p. Highest temperature 101°. A good deal of induration of epididymis and the stump of the ligated veins followed operation, which gave some discomfort. April 1895, 2 months, examination, the epididymis and stump of ligated veins form an indurated mass, no atrophy of testicle, a perfect result. December 1895, 11 months, perfect result: there is a distinct atrophy of the right testicle; induration has disappeared. January 1897, 2 years, examination, perfect result, no change in testicle since last examination. December 1898, letter, 3 years 8 months, well.

Case 111. Perfect result; last examination April 1897, 2 years 2 months; last report (letter) September 1898, 3 years 7 months. Suppuration; late infection; fat necrosis; silver wire sinus.

Surgical No. 3861. W. H., aet. 47; clergyman. Large, right inguinal hernia; irreducible, complete, acquired, indirect, of 15 years' duration and slow formation. Has worn a truss, which he discontinued at the end of 4 years, hoping that the hernia would not return. However, it did in a few weeks. Operation 6-2-95, Halsted. The sac was large and very thick at the neck and at the apex. It contained a mass of omentum, which was adherent by a number of fibrous bands. Veins small, excised. The subcutaneous fat was very thick. The muscle and the abdominal wall were very thin. Wound closed with silver wire and irrigated with 1 to 1000 bichloride. Wound opened on the 17th day for suppuration, which was not an acute affection, but a breaking down due to necrotic fat. Only a small opening was made, through which the purulent material was evacuated and the wound irrigated. Patient was discharged in 7 weeks, the wound having entirely healed except a small sinus. Highest temperature after operation was but 101° and there was never any sign of suppuration until it was examined on the 17th day. Very little induration of epididymis followed operation. August 1895, 6 months, a silver wire was discharged from the sinus, after which it healed in a few days. November 1895, 9 months, examination, wound solid, no atrophy of testicle, no induration of epididymis, a perfect result. January 1896, 11 months, examination, perfect result, testicle normal. November 1896, 1 year 9 months, letter, well. February 1897, 2 years, letter, well. April 1897, examination, 2 years 2 months, perfect result. September 1898, letter, well.

Case 112. Perfect result; last report (letter) September 1898, 3 years 6 months.

Surgical No. 3928. H. B. R., aet. 29; mechanic. Medium, right inguinal hernia; reducible, incomplete, acquired, indirect, of 12 years' duration.

Truss worn for 5 years, but unsatisfactory. Operation 5-3-'95, Bloodgood. Sac small, but very adherent to cord and veins. Veins large, excised. Muscle not very thick. Wound closed with silver wire, and irrigated with 1 to 1000 bichloride. Healing p. p. Highest temperature 100°. Very little induration of epididymis followed operation. January 1896, 10 months, letter. November 1896, 1 year 8 months, letter. February 1897, 1 year 11 months, letter. August 1897 and September 1898, 3 years 6 months, letter, well, testicle normal.

Case 113. Death on the 7th day from acute dysentery. No infection of the wound.

Surgical No. 3933. H. L., aet. 6 years. Small, left inguinal hernia; reducible, incomplete, acquired, indirect, one year's duration, following a fall. The boy was apparently in perfect health. Operation 8-3-'95, Bloodgood. Sac small, walls thick, contained omentum, which was not adherent; it was reduced. Veins small and excised. Wound closed with silver wire and irrigated with 1 to 1000 bichloride. Skin closed with silver wire and dressed with silver foil. The urine before operation was normal and at three examinations made during two days before death it was also found to be normal. Careful microscopic examination of the kidneys showed no evidence of nephritis. Soon after operation the boy became more restless than children usually are after this operation. The testicle on the operation side became swollen within 24 hours but the swelling did not increase. The rise of temperature occurred 36 hours after operation (103.8° (F.) in rectum). About 36 hours after operation patient began to complain bitterly of pain in the abdomen, which, however, was soft and neither tender nor distended. In the afternoon of this second day the temperature rose to 105.5° (F.) and pulse to 148. The pulse before this (since operation) had been between 110 and 120. On account of the high temperature and the absence of any signs of a pneumonia, the skin incision was opened. The appearance of the tissues in the wound was normal; there were a few cc. of serum; the coverslips showed red-blood cells and leucocytes, the latter not being in excess; cultures at the end of 24 hours were negative. The abdominal pain continued with very little or no remission. There was no nausea nor vomiting at any time. On the 3rd day he began to have a number of stools, which at the end of 12 hours contained mucus and blood. The stools were passed involuntary; this continued up to the time of death. Associated with these stools were rectal tenesmus and tenderness. On the 6th day the abdomen became distended and somewhat tender, and on rectal examination there was discovered a mass of congested mucous membrane about 4 cm. from the anus, which prevented further introduction of the finger and was very tender. Intussusception was suspected and an exploratory median laparotomy was performed. The rectum and sigmoid colon were swollen, their walls were thickened and their peritoneum covered with plastic lymph, otherwise the general peritoneal cavity appeared normal. The peritoneum beneath the inguinal wound was perfectly normal. Colotomy was performed to relieve the obstruction, which was complete in the rectum. Death took place eight hours after operation. Temperature was 106° on the evening of the 3rd day; it fell to 99.5° by the evening of the 4th day, and from this time up to the time of death ranged between 98° and 100°. Autopsy (No. 637) by Dr. Flexner. Intense haemor-

rhagic inflammation of sigmoid colon and rectum, with ulceration and necrosis; their entire walls were thickened and their peritoneum covered with plastic lint. The general peritoneum of the intestines was also congested and covered with fresh lint, due perhaps to the second operation. No evidence of general infection by bacteria and no infection of the wound. Kidneys and lungs normal. The organisms found in the local peritonitis were the streptococcus and bacillus coli communis. Why this boy should have developed such acute colo-proctitus, unless it was due to the bichloride of mercury, it is difficult to understand. Among 303 operations for hernia, acute dysentery has followed in but one other case—this patient, an adult, recovered. Bichloride was not used as an irrigation of the wound. During this year (1894-95) all hernia wounds have been irrigated with the solution of bichloride of mercury 1 to 1000 and without a single bad result. The amount of irrigation used in this case was, if anything, less than usual. This patient was not the only child whose wound had been irrigated with bichloride.

Case 114. Perfect result; last examination September 1897, 2 years 6 months.

Surgical No. 3973. W. N. B., aet. 4; colored. Medium, right inguinal hernia; reducible, incomplete, acquired, indirect, of 1 year's duration. Phimosis. Operation 12-3-'95, Halsted. Sac small, walls thin. A small mass of properitoneal fat beneath the sac. On drawing the sac out to suture the neck the bladder was brought distinctly into view. Veins small, excised. Muscle thin. Wound closed with silver wire and irrigated with 1 to 1000 bichloride. Healing p. p. Highest temperature 102.6°. Induration of epididymis followed operation, which disappeared in 3 weeks, leaving only the stump of the ligated veins to be felt. February 1897, 1 year 11 months, examination, perfect result. Testicle normal. September 1897, 2 years 6 months, examination, perfect result, testicle normal.

Case 115. Perfect result; last examination February 1897, 1 year 10 months.

Surgical No. 4106. J. F. W., aet. 59; carpenter. Small, right and left inguinal herniae; reducible, incomplete, acquired, indirect, of 3 years' duration, following heavy lifting. Has worn a truss, which has caused him a good deal of inconvenience. A large varicocele on the left side. Operation 19-4-'95, Halsted, both sides. Left side: Sac small and walls thin. Veins large, excised. Cord transplanted. Right side: Sac small, wall thin. Veins small, excised. Cord also excised. Muscle very thin. Wounds closed with silver wire and irrigated with 1 to 1000 bichloride. Healing p. p. Highest temperature 100.8°. The epididymis on the left side (side in which the cord was transplanted) became swollen after the operation. On the right side there was much less swelling. The right testicle, however, was much more tender than the left. On discharge from the hospital there was no swelling nor induration of the right epididymis or testicle, but tenderness was still present. On the left side the epididymis is still indurated, but there is no tenderness. September 1895, 5 months, letter, a perfect result. January 1896. 9 months, examination, perfect result, testicle normal. February 1897, 1 year 10 months, exami-

nation, perfect result, testicle normal. See Group III, Case 9, for operation on left side.

Case 116. Perfect result; last report (letter) March 1897, 1 year 10 months.

Surgical No. 4164. O. B., aet. 25; student. Small, left inguinal hernia; reducible, incomplete, acquired, indirect, of 2 weeks' duration, following strain. Operation 8-5-'95, Halsted. Sac small, walls thin. Veins large, excised. Vas deferens slightly injured with knife during operation. Wound closed with silver wire and irrigated with 1 to 1000 bichloride. Healing p. p. Highest temperature 102°. Very little induration of epididymis followed operation. January 1896, 8 months, letter, well. March 1897, 1 year 10 months, letter, well.

Case 117. Perfect result; last examination November 1897, 2 years and 6 months. Neuralgic pains in groin.

Surgical No. 4186. N. H., aet. 38; musician. Large, right inguinal hernia; reducible, complete, acquired, indirect, of 3 years' duration. The last few weeks has suffered a good deal of pain in the groin. Operation 7-5-'95, Halsted. Sac large, walls thin. Contents: A small mass of adherent omentum, which was excised. The neck of the sac contained a great amount of very vascular fat, making the closure of the sac difficult. Veins large, excised. Wound closed with silver wire and irrigated with 1 to 1000 bichloride. Healing p. p. Highest temperature 102.5°. Very little induration of epididymis followed operation. Subsequent examinations 4. October 1895, 5 months, wound solid, epididymis still slightly indurated, suffers at times from a little neuralgic pain in the groin, perfect result. November 1897, 2 years 6 months, examination, wound solid, external wound closed, sutures not palpable, testicle normal. Neuralgic pain in groin still complained of.

Case 118. Perfect result; last examination September 1898, 3 years and 4 months.

Surgical No. 4260. J. W. O., aet. 6; colored boy. Large, right inguinal hernia; reducible, complete, acquired, indirect, present since birth. Has worn a truss, which has been of little value. Operation 28-5-'95, Cone. Sac large, walls thick. Very adherent to cord and veins. Veins large, excised. Wound closed with silver wire and irrigated with 1 to 1000 bichloride. Healing p. p. Highest temperature 102°. Some induration of epididymis followed operation. September 1897, examination, 2 years 3 months, wound solid, external ring closed, testicle normal, perfect result. September 1898, examination, well.

Case 119. Perfect result; last report (letter) September 1897, 2 years 4 months. Superficial and partial suppuration of the skin incision.

Surgical No. 4255. R. L., aet. 39; coachman. Large, right inguinal hernia; strangulated 18 hours; attempts at reduction under chloroform before

admission not successful; complete, acquired, indirect, of 5 years' duration. Has worn a truss during the day. Hernia became strangulated during the night, when the patient was in bed. Operation 26-5-'95, Bloodgood. Sac large, walls thick. Very few adhesions. Contents: Intestine, which was reduced. Veins small, excised. Muscle thick. Wound closed with silver wire and irrigated with 1 to 1000 bichloride. Healing p. p. On the 16th day a small, superficial stitch abscess formed at the upper angle of the wound about a ligature on a vessel in the skin. This was opened and the cavity healed rapidly by granulation. Highest temperature 100.5°. Very little induration of epididymis followed operation. Cultures from the stitch abscess showed only colonies of the staph. pyog. albus. Examination 2 months later, wound solid, stump of ligated veins only to be felt, a perfect result. September 1897, 2 years 4 months, patient writes that the result is a perfect one, no atrophy of the testicle.

*June 1895 to June 1896.*

Case 120. Patient lost track of since operation.

Surgical No. 4391. J. M., aet. 48; milkman. Large, right inguinal hernia; strangulated, complete, acquired, indirect. Strangulation of 48 hours' duration. Hernia of 2 years' duration. Truss not worn. Operation 8-7-'95, Bloodgood. Sac large, walls very thick. Contents: Omentum very adherent to the sac, which was excised, requiring 20 ligatures. Cord not transplanted as high as usual. Veins small, excised. Muscle very thin. Wound closed with silver wire and irrigated with 1 to 1000 bichloride. Healing p. p. Highest temperature 101°. Very little induration of epididymis followed operation, which disappeared in 3 weeks, leaving only the stump of the ligated veins to be felt. February 1897 and August 1897, lost track of.

Case 121. Perfect result; last examination September 1898, 4 years.

Surgical No. 4495. S. F., aet. 48; farmer. Small, left inguinal hernia; reducible, incomplete, acquired, indirect. Has worn a truss. Operation 21-8-'94, Finney. Sac very small, wall thin, not opened. Veins small, excised. Wound closed with silver wire and irrigated with 1 to 1000 bichloride. Healing p. p. Highest temperature 101°. Very little induration of epididymis followed operation. Some epigastric distention and colic followed operation, requiring the use of Pacqueline cautery. September 1897, 3 years, patient writes that the result is a perfect one. September 1898, examination, perfect result, testicle normal.

Case 122. Patient lost track of since operation.

Surgical No. 4502. J. H. L., aet. 32; laborer. Large, right inguinal hernia; strangulated, complete, acquired, indirect. Strangulation 7 days. Hernia of 16 years' duration, reducible. Has worn a truss with comfort for about 1 year. Operation 12-8-'95, Bloodgood; ether. The sac contained about 100 cc. of blood-stained fluid, a large knuckle of small intestine, and a small piece of omentum, which was reduced. The veins were large

and excised. The muscle was divided 2.5 cm. The cord was transplanted high, and the wound closed with silver wire. 3 of the lower 4 sutures included part of the divided muscle. Healing p. p. Highest temperature 100°. No induration of epididymis followed the operation. Only the stump of the ligated veins could be felt. Cultures from the fluid in the sac were negative. September 1897, lost track of.

Case 123. Perfect result; last examination September 1898, 3 years.

Surgical No. 4653. J. H., æt. 28; car-driver. Large, left inguinal hernia; reducible, complete, acquired, indirect, of 4 years' duration and slow formation. Truss could not be worn with any comfort. The hernia was reduced only with difficulty. Operation 30-9-'95, Nassau; ether. Sac only slightly adherent to the cord. Veins small and excised. Cord transplanted high in the divided muscle. Wound closed with silver wire. Healing p. p. Highest temperature 100°. Slight induration of the epididymis followed the operation, which had about disappeared on discharge from the hospital at the end of 3 weeks. February 1896, 5 months, examination, perfect result, testicle normal, small hydrocele, present before operation. February 1897, 1 year 5 months, examination, perfect result, testicle normal, hydrocele no larger. September 1897, examination, 2 years, wound solid, sutures not palpable, hydrocele not larger. September 1898, examination, 3 years, wound solid, hydrocele a little larger.

Case 124. Patient lost track of since operation.

Surgical No. 4669. L. M., æt. 14; schoolboy. Small, left inguinal hernia; reducible, incomplete, acquired, indirect, of 2 months' duration. Has given no discomfort, and truss not worn. Operation 3-10-'95, Halsted; ether. Sac very small, not excised. Veins excised. Cord transplanted high in the divided muscle. Wound irrigated with 1 to 1000 bichloride, and closed with silver wire. Healing p. p. Highest temperature 100°. Slight induration of the epididymis followed the operation. September 1897, lost track of.

Case 125. Perfect result; last examination January 1897, 1 year 9 months. Wound suppurated. Healing 5½ weeks without discharge of any silver wire sutures.

Surgical No. 4674. M. G., æt. 45; laborer. Large, left inguinal hernia; reducible, complete, acquired, indirect, of 15 years' duration and rapid formation, following an injury to the groin. Truss worn for the first 10 years, but does not keep the hernia reduced. Operation 8-10-'95. Blood-good; ether. Wall of sac thick, but not adherent. Veins small and excised. Muscle divided for 2 cm. It was quite thick, and could be used in closing the lower portion of the wound. Cord transplanted high, and the wound closed with silver wire. Some tension was required to close the lower portion of the wound. On the 8th day the temperature rose to 103°, but soon fell to 100°. On the 10th day the wound was dressed, and the lower portion was found to contain about 20 cc. of pus. The suppu-

tion seemed to be due to the sloughing of a portion of the lower part of Poupart's ligament included in the lowest buried suture. An opening in the skin of only 2 cm. was made. This cavity was irrigated daily, and healed rapidly by granulation. None of the buried sutures came away. The patient was discharged 5½ weeks after the operation, the wound being entirely healed and solid. Very little induration of the epididymis followed the operation. Cultures from the pus demonstrated the presence of the *staph. pyog. aureus* and *albus*. January 1897, 1 year 3 months, examination, perfect result, testicle normal, scar a narrow white line. September 1897, patient has left home and his address is not known.

Case 126. Perfect result; last examination October 18, 1898, 2 years 11 months.

Surgical No. 4797. H. M. S., æt. 49; insurance agent. Large, right inguinal hernia; reducible, complete, acquired, indirect, of 24 years' duration. Has always worn a truss, which at times gives him a great deal of discomfort. Treatment by injections (25) has also been used without any result. Operation 7-11-95. Halsted. Subcutaneous fat thick. Sac small, wall at neck very thin. Remainder quite thick. Veins large, excised. Small hydrocele, situated between apex of sac and testicle. Not excised. Sac contained a small mass of adherent omentum. Cord was not transplanted as high as usual, because it was too short. Wound closed with silver wire, not irrigated. In passing one of the deep sutures through the internal oblique muscle, a large vein was punctured and a good deal of extravasation of blood into the tissues took place. Incisions had to be made through the aponeurosis of the external oblique muscle in order to find and tie the bleeding points. These incisions were afterwards closed with silk. Healing p. p. Highest temperature 102°. Very little induration of epididymis followed operation. October 1896, 11 months, examination, perfect result, testicle normal, slight induration of epididymis. January 1897, 1 year 2 months, letter, well; epididymis still indurated. August 1897, 1 year 10 months, letter, well. October 1898, 2 years, examination, perfect result, testicle normal. October 1898, letter, well, 2 years 11 months.

Case 127. Death February 1896, 3 months after operation. Tuberculosis of the lungs. Pneumonia followed operation.

Surgical No. 4827. C. T., æt. 22; colored. Medium, right inguinal hernia; reducible, complete, congenital, recurrent, of 7 years' duration. Has always worn a truss. 1 year ago, the patient states, that while in the penitentiary it was operated on against his will, without an æsthetic. The wound suppurated and the last sinus healed only 2 months ago. There is a large, irregular scar in the groin, extending down to the scrotum. Beneath the sac a reducible hernia can be felt. The opening into the abdomen is 2½ by 2½ cm. The right testicle and epididymis are normal. There is a large hydrocele on the left side. Operation 14-11-95. Bloodgood. Complete excision of all the scar tissue, the excision of the sac, except sufficient to make a tunic for the testicle. Sac contained a small mass of adherent omentum, which was excised. Neck of the sac closed with heavy black silk. Veins small, excised. Muscle split, cord trans-

planted. The sac was very adherent to the skin, to the pillars of the external ring, and there was much new connective tissue in the inguinal canal. After the sac and all this new connective tissue were excised and the muscle split, the tissue remaining, which was approximated with buried mattress sutures of silver wire, was of good thickness and vascular, so that a perfect result could be hoped for. Healing p. p. Slight bronchopneumonia followed operation with 1 or 2 elevations of temperature to 103°. 4 weeks later the hydrocele on the left side was operated on under cocaine. Patient was discharged, at the end of 6 weeks, perfectly relieved of his hydrocele and hernia. February 1896, 3 months, friends report patient died with tuberculosis of the lungs; no recurrence of the hernia.

Case 128. Perfect result; last examination March 1899, 4 years 4 months. Small hydrocele followed operation; veins excised.

Surgical No. 4831. W. F., æt. 24; mechanic. Small, left inguinal hernia; reducible, complete, acquired, indirect, small hydrocele, of 2½ years' duration, following heavy lifting. Truss has not been worn. Operation 15-11-95, Halsted. Sac small and wall thin. No adhesions. Veins large, excised. Muscle thick. Wound irrigated with 1 to 1000 bichloride. Closed with silk. Healing p. p. Highest temperature 101°. Slight induration of epididymis followed operation. December 1896, 1 year, examination, perfect result, testicle normal, very small hydrocele. March 1897, 1 year 3 months, examination, perfect result, testicle normal, small hydrocele. September 1898, 2 years 9 months, letter, well, hydrocele gives no discomfort.

Case 129. Perfect result; last examination August 1898, 2 years 8 months. Very small hydrocele followed operation; veins excised.

Surgical No. 4861. N. P., æt. 41; bricklayer. Large, left inguinal hernia; reducible, complete, acquired, indirect, of 29 years' duration, following injury to the abdomen, of slow formation. Has never worn a truss. Until 2 months ago has never given any pain or discomfort. Operation 14-12-95, Halsted. Sac very large, walls thin, excised. Neck closed with silk. The sac contained omentum, which was not adherent; it was reduced. The muscle was incised, it was quite thick. The cord was not transplanted high. Wound closed with buried mattress sutures of silver wire, irrigated with 1 to 1000 bichloride. Skin closed with subcutaneous, continuous suture of silver wire. Healing p. p. Highest temperature 101°. The first 2 or 3 days there was a good deal of epigastric pain and some distention, relieved by the Pacqueline cautery. Slight induration of the epididymis followed operation. February 1896, examination, 1 year 2 months, perfect result, stump of ligated veins palpable, very small hydrocele. August 1897, examination, 1 year 8 months, perfect result, stump of veins not palpable, hydrocele no larger, it gives no discomfort. November 1897, examination, 1 year 11 months, no change, perfect result. August 1898, examination, 2 years 8 months, no change in small hydrocele, perfect result.

Case 130. Perfect result; last examination February 1899, 3 years 2 months.

Surgical No. 4982. D. C., aet. 20; farmer. Very large, right inguinal hernia; strangulated (12 hours), complete, congenital. Hernia present since infancy, which only appears at intervals. Has worn a truss, which has not been satisfactory. On admission the patient was vomiting, but his general condition was excellent. Operation 29-12-'95. Bloodgood. The sac was large, walls thick. Contained 100 cc. of blood-stained serum and a large loop of small intestine, which was very dark in color. The constriction was at the internal ring. The sac was excised, except sufficient to make a tunic for the testicle. The neck was closed with heavy black silk. The muscle split higher than usual in order to facilitate the operation. Veins small, excised. Cord transplanted high. Wound closed as usual with silver wire and irrigated with 1 to 1000 bichloride. The patient was in such excellent condition and the circulation of the intestine so quickly established itself, that it was considered justifiable to do the longer and more radical operation. Healing p. p. Highest temperature 101.5°. There has been absolutely no discomfort following operation, except the patient has required catheterization for 5 days. December 1896, examination, 1 year, perfect result, stump of ligated veins palpable, testicle normal. August 1897, examination, 1 year 8 months, perfect result, stump of veins not palpable, testicle normal.

Case 131. Perfect result; last examination August 1898, 2 years 9 months.

Surgical No. 5055. W. H. O., aet. 26; laborer. Medium, right inguinal hernia; reducible, complete, acquired, indirect. Operation 31-12-'95. Halsted; ether. Walls of sac thin. Veins large, excised. Cord transplanted high in the thick internal oblique muscle. Wound closed with silver wire, without irrigation, and dressed with silver foil. Healing p. p. Highest temperature 100.5°. Only slight swelling of the stump of the ligated veins followed the operation. No induration of the epididymis. Upon being discharged from the hospital, 4 weeks after the operation, the wound was absolutely solid, and no change could be made out in the scrotum except the small stump of the ligated veins. February 1897, 1 year 2 months, examination, perfect result, testicle normal. August 1898, 2 years 9 months, examination, perfect result, testicle normal.

Case 132. Perfect result; last examination October 1897, 1 year and 8 months. Small hydrocele followed operation; veins excised.

Surgical No. 5078. J. F. H., aet. 34, railroad clerk. Large, right inguinal hernia; reducible, complete, acquired, indirect, of 7 months' duration, following a strain on jumping from a train. The patient has worn a truss, but it gives a great deal of discomfort. Operation 4-2-'96. Bloodgood; ether. The wall of the hernial sac was thick and very vascular, and the end of the omentum was adherent to the sac. The cord was quite adherent to the sac, and was separated with difficulty. The veins were

large and excised. The internal oblique muscle was split for a distance of 2 cm. In closing the wound it was possible to so transplant this divided muscle that it filled up the wound for a distance of 3.5 cm. The external ring was not completely closed down to the pubes, for the approximation of the tendinous structures would have required too much tension, which might have endangered healing. Wound healed p. p. No induration of the epididymis. Only the stump of the ligated veins to be felt. Examination of the wound on discharge from the hospital demonstrated that the external ring was completely closed, although at the time of the operation this suture had not been drawn sufficiently tight to approximate the pillars of the ring. October 1896, 8 months, examination, wound solid, external ring closed, small hydrocele. March 1897, 1 year, examination, wound solid, hydrocele no larger. October 1898, examination, wound solid, external ring closed, hydrocele no larger, testicle and epididymis normal, absolutely no discomfort, wire sutures not palpable.

Case 133. Perfect result; last examination January 1897, 11 months; last report (letter) January 1899, 2 years and 11 months.

Surgical No. 5101. B. M., aet. 20; laborer. Small, left inguinal hernia; reducible, incomplete, acquired, indirect, of 11 years' duration. Truss not worn. The rupture gives very little discomfort. Has tried the injection treatment for 6 months without any result. Operation 20-2-'96, Bloodgood; ether. The sac contained adherent omentum, which was excised. The veins were small and not excised. The cord was transplanted high in the divided muscle. The wound was closed with silver wire, 1 suture above the cord and 5 below, 4 of which on the upper side and 2 of which on the lower (Poupart's ligament) included the divided muscle. Healing p. p. Highest temperature 100°. No induration of the epididymis followed the operation. January 1897, 11 months, examination, perfect result, external ring closed, testicle normal. November 1897, 1 year 9 months, letter, perfect result.

Case 134. Perfect result; last examination September 1898, 2 year 6 months. Hernia congenital, sac contained fluid and was irreducible.

Surgical No. 5107. N. W. B., aet. 5; schoolboy. Small, left inguinal hernia; reducible, incomplete, congenital. Associated with a supposed hydrocele of the cord. Of one year's duration. Has given no pain or discomfort. At times it remains reduced for a number of days; at other times there is a tense mass in the groin like a hydrocele, which cannot be reduced. Operation 9-2-'96, Halsted; ether. Under ether the tumor in the groin was easily reduced. The sac was small and contained omentum. Veins small, not excised. Muscle divided. Wound closed with silver wire, one suture above and five below cord. No irrigation. Healing p. p. Highest temperature 101°. No induration of the epididymis followed the operation.

Note.—In this case the tumor, when it was irreducible, was very much like a hydrocele, and as it would remain so frequently four or five days without pain or nausea, it was perhaps distended with fluid, the reduc-

tion of which (the fluid) was prevented by the stump of the omentum in the neck of the sac. (See Group X, Surgical No. 4177, Case 9, femoral hernia with a similar condition.)

January 1897, 11 months, examination, perfect result, testicle normal. August 1897, 1 year 6 months, examination, perfect result, testicle normal. September 1898, 2 years 6 months, examination, perfect result, testicle normal.

Case 135. Perfect result; last examination November 1898, 2 years 9 months. Hernia right side; operation for varicocele left side.

Surgical No. 5132. A. G., aet. 52; policeman. Medium, right inguinal hernia; reducible, incomplete, acquired, indirect, of 8 years' duration and slow formation. Truss worn with comfort, except 2 months ago, when the rupture became irreducible for a few hours. Large varicocele on the left side. Operation 24-2-96, Bloodgood; ether. The subcutaneous fat was very thick. Sac small, but surrounded by a great deal of vascular properitoneal fat, which was excised with the sac. Veins large, excised. The internal oblique muscle was high, very thin, and was infiltrated with fat. It was divided for 2.5 cm., through which the cord was transplanted. The wound was closed with silver wire. In passing the sutures through the tissues, which were quite thin, they were caught with a needle in 2 or 3 places and rolled upon themselves in order to increase the thickness and strength of the sutured tissues. The spermatic veins on the left side were excised through an incision in the groin. Healing of both wounds p. p. Highest temperature 100°. Slight induration of the epididymis and swelling of the testicles on both sides, more marked on the left side (varicocele). October 1896, 8 months, examination, perfect result, external ring closed, the epididymis on both sides is perhaps slightly indurated, the stump of the ligated veins is 8 mm. in diameter, both testicles normal; patient, a policeman, also exercises at wrestling. February 1897, examination, 1 year 6 months, perfect result, both for hernia and varicocele, both testicles normal, stump of ligated veins has disappeared. August 1898, examination, perfect result. November 1898, examination, perfect result.

Case 136. Perfect result; last report (letter) November 1897, 1 year 9 months. Hydrocele followed operation; veins excised.

Surgical No. 5133. P. M., aet. 47; cook. Small, right inguinal hernia; reducible, incomplete, acquired, indirect, of 2 years' duration. Truss not worn. Operation 22-2-96, Halsted; ether. Sac small, surrounded by a great mass of properitoneal fat. Veins large and excised. The cord was transplanted in the divided aponeurosis of the external oblique muscle, the internal oblique muscle being too thin and too high. Wound closed with silver wire. Healing p. p. Highest temperature 100°. Slight induration of the epididymis followed the operation. A great deal of epigastric pain and some distention of the abdomen for a few weeks after the operation. November 1897, letter, 1 year 9 months, no return of the hernia, testicle enlarged (hydrocele).

Case 137. Perfect result; last report (letter) March 1897, 1 year.

Surgical No. 5188. C. S., aet. 22 years; butcher. Small, right inguinal hernia; reducible, incomplete, acquired, indirect, of 10 months' duration, following an injury. Has worn a truss with comfort. Operation 10-3-'96, Halsted; ether. Sac small, no adhesions. Veins large and excised. Cord transplanted in the divided muscle, which was quite thick. Wound closed with silver wire. Healing p. p. Highest temperature 101.2°. No induration of the epididymis followed the operation. March 1897, letter, 1 year, well.

Case 138. Perfect result; last examination September 1897, 1 year 6 months. Double inguinal herniæ; internal oblique muscles too high and thin for division; conjoined tendon relaxed but not obliterated. Hydrocele of left testicle after operation; veins excised. Atrophy of right testicle; cord and vessels excised.

Surgical No. 5262. J. W. W., aet. 50; laborer. Medium, left inguinal hernia; reducible, incomplete, acquired, indirect, of 1 year's duration. Operation 30-3-'96, Bloodgood; ether. Sac small. Veins small, excised. The cord was transplanted in the divided aponeurosis of the external oblique muscle, the internal oblique muscle being too thin and high to utilize. Wound closed with silver wire. At the same time a large, complete, reducible, inguinal hernia on the right side was operated upon, but the veins and cord were excised. (See Group III, Case 10.) The only difference between the operation on the right and left side was the transplantation of the cord on the left, and the excision of the cord and veins on the right. On both sides the aponeurosis of the external oblique muscle was thin and relaxed. All the tissues behind the inguinal canal were so relaxed that one could pass almost the entire hand into the abdomen. On both sides the internal oblique muscle was too thin and too high to be divided. In closing the wound with silver the needle was made to pass through the tissues 2 or 3 times, so that when the sutures were drawn, these tissues were rolled upon themselves, and their thickness increased. In the lower sutures the conjoined tendon and sheath of the rectus muscle were included. Healing of both wounds p. p. Highest temperature 101°. Following the operation there was no induration of the epididymis or testicle on the left side, but on the right side (cord excised) there was a good deal of induration of the epididymis, and it could not be differentiated from the mass of ligated veins. There was also some swelling of the testicle. January 1897, 10 months, letter, well. September 1897, 1 year 6 months, examination, both wounds solid, both external rings closed. Small hydrocele followed operation on left side (the veins had been excised). The right testicle has atrophied, following the operation in which the cord had been excised, and there had been a good deal of epididymitis. Atrophy began 6 weeks after operation. Two silver sutures palpable. The result is most satisfactory, considering the condition of the tissues of the abdominal wall.

Case 139. Patient lost track of since operation. Adherent omentum and sac excised in one piece from above downwards.

Surgical No. 5344. R. E., aet. 21; farmer. Medium, right inguinal hernia; reducible, complete, acquired, indirect, of 6 years' duration. Has worn a truss for one year. Has large varicocele on the left side. Operation 17-4-'96, Bloodgood; ether. About the sac there was a great deal of vascular properitoneal fat. After the division of the aponeurosis of the external oblique and internal oblique muscle the peritoneal cavity was opened above the neck of the sac. As the omentum was found to be adherent (very intimately) about the neck of the sac, it was ligated through this opening into the peritoneal cavity, and the sac with its contents of omentum was removed in one piece from above downwards. Veins small, not excised. Wound closed with silver wire, 1 above and 4 below the transplanted cord. Conjoined tendon was wide and firm, and internal oblique muscle thick, so that it could be transplanted beyond the outer border of the conjoined tendon. At the same time the spermatic veins were excised through an incision in the left groin. Both wounds healed throughout per primam. Highest temperature 100.5°. No induration of the epididymis or swelling of the testicle followed operation.

Case 140. Perfect result; last examination July 1896,  $2\frac{1}{2}$  months. Broncho-pneumonia with abscess of lung followed operation.

Surgical No. 5360. P. Van E., aet. 33; clerk. Small, left inguinal hernia; reducible, complete, acquired, indirect, of 2 weeks' duration and rapid formation. Operation 27-4-'96, Bloodgood; ether. Sac very small. Veins small, not excised. Cord transplanted in divided muscle, which was quite thin. The wound was closed with silver wire. Healing p. p. No induration of the epididymis followed the operation. Although the patient took ether well, a severe attack of broncho-pneumonia followed the operation, with a temperature between 100° and 102°. No tubercle bacilli were found in the sputa. July 1896, the patient has been in the medical wards for 4 weeks. There is an abscess cavity in the apex of the right lung, and tubercle bacilli have been demonstrated in the sputa. Discharged, improved, July 17th, 1896. Lost track of since. August 1898, letter returned by the postmaster marked "Dead."

Case 141. Recurrence at the lower angle of the wound associated with obliteration of the conjoined tendon.

Surgical No. 5435. J. T., aet. 37; engineer. Large, left inguinal hernia; reducible, incomplete, acquired, recurrent 3 weeks after operation; right hernia of 3 years' duration, following an injury; left hernia of 6 months' duration. Both sides were operated upon in New Orleans, La. The wounds healed p. p., but the herniae recurred 3 weeks after leaving the hospital, and were larger than before the operation. Although the herniae do not descend into the scrotum, they are very large on both sides, and the opening into the abdominal cavity begins just above the pubes. The conjoined tendon on both sides is obliterated. The testicle on the

right side is distinctly atrophied. This atrophy followed the operation, and for this reason it was decided to excise the veins and cord on the right side, and transplant the cord on the left side. Operation 12-5-96, Bloodgood; ether. On the right side veins and cord were excised. On the left side the veins, which are large, were excised, and the cord transplanted into the divided internal oblique muscle. On the left side there was no distinct hernial sac, but the peritoneum, covered by fat, bulged from the pubes upwards and outwards for 5 cm. to the level of the internal oblique muscle. Between this and the skin there was only scar tissue. The peritoneal cavity was not opened. The deep epigastric vessels could not be found. They must have been ligated at the first operation. The wound was closed with buried sutures of silver wire, 3 above and 4 below the cord. These sutures included on the upper side the divided internal oblique muscle, the aponeurosis of the external oblique muscle, and sheath of the rectus; on the lower side for a distance of 3 cm. below the cord, the divided internal oblique muscle and Poupart's ligament, which was rolled upon itself 3 times. By this procedure both muscular tissue and aponeurosis were approximated over the opening into the abdomen, and the transplantation of the internal oblique muscle added much to the strength of the closed wound. The operation on the right side was the same, except that the cord was ligated and excised. There was a distinct sac on the right side, which was excised, and the opening into the peritoneal cavity, which measured 5 cm., was closed with silk. Healing p. p. Highest temperature 100°. No discomfort whatever followed the operation. Following the operation no change whatever took place in the right testicle and epididymis. On the left side the epididymis became slightly indurated, but disappeared at the end of the second week. The patient remained in the hospital 1 week after getting out of bed. September 1897. lost track of.

May 19, 1899, three years since operation. The patient, who has been in Cuba, returns for examination. In the lower angle of the wound on the left side there is a distinct bulging, which the patient noticed 3 weeks after operation, and states that it has not increased much in size since then. The bulging is reducible and one can introduce two fingers into the opening, which is situated at the outer edge of the rectus muscle. In the lower angle of the wound on the right side the tissues feel distinctly thinner than those of the upper two-thirds of the wound, but there is no distinct recurrence. Second operation, 22-5-99; Bloodgood. The recurrent hernia was situated at the outer side of the outer border of the rectus muscle. The opening measured about 2x2 cm. The wound was solid at the position of the transplanted cord. (The veins had been excised at the first operation.) The sac was excised. Its contents, non-adherent omentum, was reduced. All the scar tissue was excised, including the vas deferens. Wound was closed with silver wire, including the transplanted rectus muscle and the divided and transplanted internal oblique muscle. Healing. Late suppuration partial.

Case 142. Perfect result; last examination August 1898, 2 years 2 months.

Surgical No. 5529. H. S., aet. 12. Medium, right inguinal hernia; reducible, complete, acquired, indirect, of 2 years' duration, following an

injury to the groin by baseball. Hernia appeared 2 years after injury. Although the hernia extends into the scrotum, it does not extend as far down as the testicle. Operation 13-6-'96, Coleman; ether. Sac small, no adhesions. Veins small, not excised. Between the sac and the testicle there was a small hydrocele of the cord, which was excised. Cord transplanted in the divided internal oblique muscle. Wound closed with silver wire, 1 above and 4 below the transplanted cord. In this case the internal oblique muscle was thick and could be transplanted, so that all of the 4 lower sutures on the upper side included this divided muscle, together with the aponeurosis of the internal oblique muscle and the conjoined tendon, and on the lower or Poupart's ligament side, the divided muscle was included in 2 of the sutures. Healing p. p. Highest temperature 100°. No swelling of the testicle and no induration of the epididymis followed the operation. December 1896, 6 months, examination, perfect result, testicle normal, no return of the hydrocele. August 1898, examination, 2 years 2 months, perfect result, testicle normal.

Case 143. Perfect result; last examination September 1897, 1 year 3 months. Small hydrocele followed operation; hernia congenital; sac sutured.

Surgical No. 5538. H. O., aet. 13; schoolboy. Small, right inguinal hernia; reducible, complete, congenital, of 2 months' duration. It was interesting to note that before the appearance of the hernia, the patient experienced pain in the knee and ankle on the right side, and he walked with a limp. After the appearance of the hernia, and the application of a truss, the pain and limp disappeared. Operation 16-6-'96, Finney; ether. Sac contains a small piece of omentum, with a few adhesions. Adhesions cut and omentum reduced. Veins very large and excised. Cord transplanted in divided muscle, which was thick. Wound closed with silver wire. The portion of the sac over the testicle was sutured with fine black silk to make a new tunica. Healing p. p. Highest temperature 100°. No change in the testicle or epididymis. Only the stump of the ligated veins to be felt. December 1896, 6 months, examination, perfect result, testicle normal. February 1897, 8 months, letter, well. September 1897, examination, 1 year 3 months, wound solid, external ring admits the little finger, small hydrocele, in other respects testicle and epididymis normal, no pain or discomfort, sutures not palpable.

Case 144. Perfect result; last report (by physician) August 1897, 1 year. Hydrocele followed operation; congenital hernia; suture of sac.

Surgical No. 5584. A. H. T., aet. 20; broom-maker. Small, left inguinal hernia, of 8 years' duration. Truss gives discomfort. Reducible, complete, congenital. Operation 3-7-'96, Finney; ether. Veins small, excised. Divided muscle thick. Neck of sac closed with one suture. Tunic sutured over testicle. Closed with silver wire. Healing p. p. Highest temperature 101°. Following the operation a small hydrocele developed. No swelling of testicle and no induration of epididymis. Cultures from the skin were *staphylococcus albus*. March 1897, 8 months, letter, well, hydro-

cele no larger. August 1897, report from physician, perfect result, no note of the hydrocele.

Case 145. Perfect result; last examination March 1897, 5 months; last report (letter) August 1897, 10 months. Wound suppurated.

Surgical No. 5591. J. L., aet. 24; butcher. Very small, left inguinal hernia; reducible, incomplete, acquired, indirect, of a few days' duration, following immediately after a fall when the patient was carrying a heavy piece of meat upstairs. He noticed pain at once and a few hours later a protrusion in the groin. Operation 3-7-'96, Walker; ether. There was no distinct sac. The peritoneal cavity was not opened. The veins were excised and the cord transplanted in the divided muscle. Wound closed with silver wire. On the seventh day there was a sudden rise of temperature to 102.5°, and the wound was found to be distended with purulent material, and there was a wide area of erythema and edema of the skin. The skin incision was completely opened; the suppurations seemed to have been caused by the sloughing of a portion of the Poupart's ligament, which had been strangulated by one of the deep wire sutures. Cultures, staphylococcus aureus and albus. The wound healed by granulation in 6 weeks. None of the deep silver wire sutures came away. Following the operation there was no induration of the epididymis.

Note.—The operator in this case thought that he tied the lowest mattress suture with too much tension, strangulating a portion of the Poupart's ligament just above the pubic bone. It is interesting to note in this case that 5 mattress sutures of silver wire healed under granulation tissue.

March 1897, 5 months, examination, perfect result, testicle normal. August 1897, letter, well, 10 months, patient in Germany.

Case 146. Perfect result; last examination August 1897, 1 year. Small hydrocele followed operation; hernia congenital; sac sutured.

Surgical No. 5607. J. C. P., aet. 19; student. Medium, right inguinal hernia; reducible, complete, congenital, of 3 years' duration, following a running race. The hernia became complete after a football game 6 months ago. Has not worn a truss. The rupture gives very much discomfort. Operation 9-7-'96, Bloodgood; ether. Sac small, walls thin. Lower portion of sac sutured over testicle. Veins small, excised. Divided muscle thick. Wound closed with 2 silver mattress sutures above and 3 below the cord, and 2 fine black silk sutures in the aponeurosis, one on each side of the cord. Before the operation, when the hernia was reduced, the testicle was drawn up to the pubes; for this reason the cord was not transplanted as high as usual. Divided muscle was included in all but the lowest suture. Healing p. p. Highest temperature 101°. Very slight induration of the epididymis followed the operation; the small stump of the ligated veins could be felt.

Note.—In this case the divided internal oblique muscle could be transplanted, so that it was included in all but the lowest suture.

January 1897, 6 months, examination, perfect result, external ring closed,

testicle normal; a small hydrocele has formed in the portion of the sac sutured over the testicle. August 1897, examination, 1 year, perfect result, testicle in place and normal, hydrocele a little larger, it gives no discomfort.

Case 147. Perfect result; last examination January 1898, 1 year 6 months; letter November 1898, well, 2 years 4 months.

Surgical No. 5612. H. W. R., aet. 19; clerk. Small, left inguinal hernia; reducible, complete, acquired, indirect, of 2 years' duration, following a kick in the groin. He suffers a good deal of pain in the groin with any exertion. A truss was worn for about a month, but gave much discomfort. Operation 10-7-'96, Finney; ether. The sac was very adherent to the cord and surrounding tissues, making a difficult dissection. Veins excised. Divided muscle thick. Wound closed with silver wire. Irrigation 1 to 1000 bichloride. All but the lower sutures passed through the divided muscle. Healing p. p. Highest temperature 102°. Following the operation there was a slight swelling and tenderness of the epididymis. In this case there was more than the usual induration of the epididymis, and it is to be remembered that during the operation the vas deferens and its vessels were quite adherent to the sac. October 1897, 1 year, letter, well. January 1898, 1 year 6 months, examination, perfect result, wound solid, testicle normal.

Case 148. Perfect result; last examination December 1897, 1 year 5 months.

Surgical No. 5615. L. S., aet. 7 years; schoolboy, colored. Medium, right inguinal hernia; reducible, complete, congenital, hernia present since birth. Operation 10-7-'96, Garrett; ether. Sac very adherent to cord and surrounding tissues, making a very difficult dissection. The portion of the sac left on the testicle was not sutured. Veins excised. Divided muscle quite thick. Wound closed with silver wire, one suture above and five below cord. The opening into the abdominal cavity was quite large; it required four silk sutures to close it. The sac contained the appendix, which was removed, and a covering of peritoneum sutured over the stump. Healing p. p. Highest temperature 101°. Following the operation there was a good deal of induration of the epididymis and swelling of the testicle.

Note.—The induration of the epididymis was more than usual and there was also some swelling of the testicle. In this case the operation was a difficult one and the testicle was drawn up out of the scrotum. Most of the induration and all of the swelling had disappeared in 4 weeks.

December 1897, 1 year 5 months, examination, perfect result, wound solid, external ring closed; the testicle, epididymis and cord are still large and indurated; no hydrocele.

Case 149. Perfect result; last examination August 1898, 2 years 1 month. Very small hydrocele; veins excised.

Surgical No. 5638. D. C. A., aet. 33; gardener. Medium, left inguinal hernia; reducible, complete, acquired, indirect, of 6 years' duration and

slow formation, following an injury. Truss not worn. Operation 20-7-96, Finney; ether. Sac small, walls thin. Veins large, excised. There was a constriction of the sac just at the neck, consisting of a ring of fibrous tissue, 4 mm. in diameter, while the diameter of the sac beyond was 1.5 cm. Divided muscle thick. Wound closed with silver wire, one above and four below cord. All included divided muscle except the lowest. Two additional sutures of fine black silk in the aponeurosis above and below the cord. Wound healed p. p. Highest temperature 100°. Very slight induration of the epididymis. February 1897, 6 months, letter, well. August 1897, examination, 1 year 1 month, perfect result, testicle and epididymis normal; there is a very small hydrocele, which gives no discomfort and has not been noticed by the patient. August 1898, examination, perfect result, hydrocele has disappeared.

Case 150. Perfect result; last examination November 18, 1898, 2 years and 2 months since operation. Atrophy of the testicle; veins excised.

Surgical No. 5725. L. L., aet. 3 years; colored. Medium, left inguinal hernia; reducible, complete, congenital, duration not stated. 4 days before admission the hernia became irreducible, associated with nausea, much discomfort and constipation. On admission hernia was easily reduced. Operation 22-8-96, Walker; ether. Wall of the sac was very thick and quite adherent. A portion of the sac was left with the testicle, but not sutured. Veins small, excised. Wound closed with silver wire, two sutures above and four below the transplanted cord, including the divided and transplanted internal oblique muscle. Healing per primam. Highest temperature 101°. Convalescence uneventful. It is noted that on the fifth day there was a slight induration of the epididymis and a little swelling of the testicle. At the end of 3 weeks the induration of the epididymis had almost disappeared. Examination, 5 months, wound solid, testicle normal in size and consistency. Near the epididymis there is a small nodule—probably the stump of the ligated veins. Examination, September 1896, 1 year and 6 months, the left testicle is now smaller than the right. In consistency it is softer and it has lost its elasticity; it feels doughy. The induration of the epididymis has disappeared and stump of the ligated veins is not to be felt. Atrophy of the testicle has taken place. Examination November 15, 1898, 2 years and 2 months since operation, wound solid; the left testicle is smaller and softer than it was when examined 8 months ago.

Note.—This is the first case in which atrophy of the testicle has been observed when the veins have been excised at the operation for hernia, and in which after operation there was but a very slight degree of epididymitis.

Case 151. Perfect result; last report (by physician) September 1897, 1 year.

Surgical No. 5776. D. G. L., aet. 27; carpenter. Medium, left inguinal hernia; reducible, complete, acquired, indirect, of 2 years' duration, follow-

ing heavy lifting. At first it gave a great deal of pain and was reduced with great difficulty. A truss was immediately applied and has been worn since, 1 year and 9 months ago. The hernia received the injection treatment at Pittsburgh for 5 months without success. Operation 27-8-96, Walker; ether. The sac and cord and surrounding tissues were matted together by connective tissue, making the dissection a difficult one. Veins excised. Wound closed with silver wire. Divided muscle was transplanted over one-half of the wound. Healing p. p. Highest temperature 100°. Slight induration of the epididymis, a matting together of the veins and the vas deferens in the scrotum and a slight enlargement of the testicle followed the operation.

Note.—The induration of the epididymis, together with the vas deferens and the stump of the ligated veins, in this case was quite marked, but it is to be remembered that everything in the inguinal canal was matted together by the adhesions, due most likely to the injections.

February 1897, 6 months, letter, well, testicle still swollen, works hard. September 1897, 1 year, physician writes that the wound is solid and the testicle normal; patient does heavy labor.

Case 152. Perfect result; last examination August 1897, 11 months. Veins excised; large hæmatocoele in scrotum; complete atrophy of testicle, 5 months. Examination June 1899, 2 years and 9 months. Perfect result.

Surgical No. 5782. L. D., aet. 14; box-maker. Small, left inguinal hernia; reducible, incomplete, congenital, of 1 year's duration. The hernia frequently remains reduced for many days at a time. One week ago the hernia became irreducible for a few hours. Operation 2-9-96, Finney; ether. Sac large, walls thick, and adherent to the cord. Veins excised. Muscle divided. Wound closed with silver wire. The operation was a difficult one, and there was a good deal of manipulation of the tissues. Healing p. p. Following the operation the testicle became rapidly and very largely swollen, and there was ecchymosis of the scrotum on the left side, associated with a temperature of 104° and pulse of 148. The rise of temperature began 24 hours after the operation and lasted about 12 hours. On the second, third and fifth days there was a rise of temperature to 102°. The swelling in the scrotum rapidly subsided; at the end of 5 weeks, when the patient left the hospital the testicle was enlarged, the epididymis indurated, and above the epididymis was a mass in which the vas deferens could not be differentiated. The dissection of this case was a somewhat difficult one, and, without doubt, following the operation there was hæmorrhage from the stump of the ligated veins, with extravasation of blood about the epididymis and testicle, producing, no doubt, a marked epididymitis, which might be followed by atrophy of the testicle. It is also interesting to note the sudden and high rise of temperature associated with blood in the tissues. January 1897, 4 months, letter, well. February 1897, 5 months, examination, perfect result, complete atrophy of the testicle; an abscess formed in the scrotum two weeks after leaving the hospital; sinus persisted 1 month. August 1897, examination, 11 months, perfect result, the testicle has completely disappeared.

Case 153. Perfect result; last report (letter) August 1898, 2 years.

Surgical No. 5790. H. P. H., æt. 34, farmer. Small, left inguinal hernia; reducible, acquired, incomplete, indirect, of 13 years' duration, following injury to the groin. For the last 3 weeks patient has suffered a great deal of pain in the left groin and scrotum. There was also a large varicocele on the same side. The external ring was large and there was a slight impulse on coughing, the only evidence of hernia. Operation 3-9-'96, Walker. Veins excised (by the method described in this paper). Wound closed with silver wire, one above and four below the transplanted cord. There was no distinct sac and the peritoneal cavity was not opened, but there was a good deal of properitoneal fat filling up the inguinal canal, which was not excised. The divided internal oblique muscle was thin and could be used only for suture material on each side of the transplanted cord. Healing p. p. Highest temperature 101°. Following the operation there was slight and temporary swelling of the veins only. No swelling of the testicle or induration of the epididymis. April 1897, 6 months, patient writes that the wound is solid, but he can still feel the stump of the ligated veins in the scrotum. October 1897, 1 year, patient writes that the wound is solid, but that he still suffers from pain in the groin and testicle. August 1898, letter, well.

Case 154. Perfect result; examination August 1898; 2 years.  
*Gloves first used.*

Surgical No. 5810. J. R. J., æt. 18; colored, student. Small, left inguinal hernia; reducible, incomplete, acquired, indirect, of 1 year's duration, following a game of baseball, of rapid formation, associated with a good deal of pain in the groin, since which time, when patient takes any violent exercise, he experiences pain in the groin and notices a tumor there, both of which disappear after a few days of rest. It is to be noted that the left testicle is one-half the size of the right. Operation 15-9-'96, Bloodgood; ether. Sac very small, not opened. Veins small, excised. Muscle divided. Cord transplanted. Wound closed with silver wire, 2 sutures above and 5 below the cord. *Operator wore gloves.* Healing p. p. Highest temperature 102°, associated with a slight bronchitis and a purulent urethritis, which began on the 10th day and lasted 4 days. Not the slightest change was noticed in the testicle or the epididymis. March 1897, letter, well, 4½ months. August 1897, 11 months, letter from physician, perfect result. August 1898, examination, 2 years, perfect result, testicle normal.

Case 155. Perfect result; last report (by physician) September 1898, 2 years.

Surgical No. 5869. W. R. A. C., æt. 28; hostler. Medium, left inguinal hernia; reducible, complete, acquired, indirect, of 8 years' duration. Has always worn a truss since hernia was first noticed. Operation 7-10-'96, Bloodgood; ether. Sac medium size, walls thin. No adhesions. Veins excised. Wound closed with silver wire, 1 above and 5 below cord. All

the deep sutures except the last included divided muscle. Gloves worn by operator. Healing p. p. No induration of the epididymis.

Note.—It is to be noted in this case that, although the complete operation was done and that the mass of veins was exercised, not the slightest swelling or induration of the epididymis or testicle followed the operation, and nothing was to be felt in the scrotum different from that before the operation except the small stump of the ligated veins. In this case there were no adhesions and the dissection was not a difficult one.

September 1898, 2 years, letter from physician, perfect result, testicle normal.

Case 156. Perfect result; last report (letter) June 1899, 2 years and 8 months.

Surgical No. 5876. C. R. C., aet. 27; yardmaster. Medium, left inguinal hernia; reducible, complete, congenital, of 18 months' duration. Has worn a truss for the past 2 weeks. Operation 8-10-'96, Bloodgood; ether. Sac long and narrow, with a complete constriction midway between the neck and testicle. A portion of the sac next to the testicle was swabbed with pure carbolic and closed with silk. Veins small, excised. Wound closed with silver wire, 1 above and 4 below the cord. All of the sutures on the upper side and 3 of the sutures on the Poupart's ligament side included the divided internal oblique muscle. Healing p. p. Highest temperature 102°. Very slight induration of the epididymis and a small hydrocele about a centimeter in diameter followed the operation.

Note.—In this case the swabbing with pure carbolic of the portion of the sac which was sutured over the testicle seemed to have no effect in the prevention of a hydrocele.

March 1897, 5 months, letter, well.

Case 157. Perfect result; last examination November 1898, 2 years 2 months.

Surgical No. 5872. J. A. W., aet. 22; clerk. Small, left inguinal hernia; reducible, complete, congenital, of 12 years' duration, following heavy lifting. Following this strain, patient frequently had pains in the groin, but not until 2 years later did he notice any swelling. During the next 4 years the swelling increased in size. Has always been reducible, but gives much pain and discomfort. Patient seeks operation in order to be admitted into the army, as now the regulations will permit of the admission of men on whom a radical cure for hernia has been performed. Operation 30-9-'96, Bloodgood; ether. Sac long, but very small in diameter. Walls thin. Contents: Small mass of omentum, adherent to the neck of the sac. Portion of sac left with testicle sutured. Veins small, excised. Wound closed with one silver wire above and four below cord, the upper 5 and the lower 2½ including the divided internal oblique muscle. The skin wound was closed with a subcutaneous suture of catgut, sterilized by the Kumol method. Healing p. p. Highest temperature 101°. Very slight induration of the epididymis, but no swelling of the testicle followed the operation.

Note.—This case demonstrates the importance of the extra room given by the division of the aponeurosis of the external oblique muscle and the

internal oblique muscle, because after dividing these tissues and the cremasteric and infundibuliform fascia, and exposing and opening the sac, the mass of omentum was found very adherent to the neck of the sac.

Finding this, the peritoneal cavity was opened above the internal ring, and through this opening the adhesions between the omentum and the neck of the sac were easily cut, and the mass of omentum reduced without excision, after which the sac was excised and the opening in the peritoneal cavity closed with silk. Healing p. p. Highest temperature 101°. Slight induration of the epididymis, considerable epigastric distension and abdominal colic followed the operation. The patient had to be catheterized for 3 days. There was a small area of ecchymosis in the skin of the scrotum. January 1897, 4 months, perfect result, testicle normal, very slight induration of the epididymis, no hydrocele, married 2½ months, wife pregnant. August 1897, examination, 11 months, perfect result, testicle normal, induration of epididymis has disappeared. February and November 1898, examination, 1 year 4 months, perfect result. Gloves worn.

Case 158. Perfect result; last examination December 1897, 1 year 2 months. September 1898; dead. Small hernia, peritoneum not opened; internal oblique muscle not divided; veins large, excised; sac of hydrocele excised; cord transplanted.

Surgical No. 5887. J. E. S., aet. 46; colored coachman. Small, right inguinal hernia; reducible, acquired, incomplete, indirect. Associated with a very large hydrocele. Operation 10-10-'96, Bloodgood; ether. No distinct sac. Peritoneal cavity not opened. Internal oblique muscle not divided, but veins excised. Hydrocele excised through the same incision. Cord transplanted, the internal oblique muscle, conjoined tendon and aponeurosis of the external oblique muscle were sutured to Poupart's ligament with 3 mattress sutures of silver wire below the cord. One suture was passed through the divided aponeurosis of the external oblique, including the internal oblique muscle above the cord. The method of operation was as follows: Skin incision, division of the aponeurosis of the external oblique muscle, division of the cremasteric and infundibuliform fascia (which later was included by the deep suture), separation and excision of the larger bundle of veins; the hydrocele with the testicle was then drawn up into the wound, the sac opened and excised, and the testicle replaced without suture of a new tunic. Healing p. p. Highest temperature 100.5°. Following the operation there was no discomfort whatever. There was some swelling of the testicle, associated with a little tenderness and slight oedema of the scrotum. This rapidly disappeared, and on discharge there was still a slight induration of the epididymis, above which one could feel a small mass—the stump of the ligated veins.

Note.—In this operation, although the veins were excised, and the sac of a very large hydrocele was also excised, the induration of the epididymis following was very slight. This patient had been operated on for a direct inguinal hernia on the left side one year ago (see Group II, Case 7. Surgical No. 4663). There has been no recurrence.

January 1897, 3 months, examination, perfect result, external ring closed,

testicle normal; *globus major* of the epididymis slightly indurated; *vas deferens* and few veins normal, a small indurated mass near *globus major* and testicle represents the stump of the ligated veins; no evidence of hydrocele; the hydrocele sac on the other side, which was only tapped and injected, is filling again. May 1897, 7 months, examination, perfect result, no change since last examination, excision of sac of left hydrocele through incision in scrotum under cocaine. Healing p. p. August 1897, examination, 10 months, perfect result, external ring closed, both testicles normal, no induration of the epididymis. December 1897, examination, 1 year 2 months, perfect result; since last examination there has been a small collection of fluid in the tunica vaginalis of the left testicle, which gives no discomfort. September 1898, letter, dead, no recurrence of hernia.

Case 159. Perfect result; last report (by physician) December 1898; letter, well, 2 years. The sac contained the colon, and the mesocolon formed part of the sac. Hydrocele followed operation; veins excised.

Surgical No. 5898. C. S., aet. 45; hotel-keeper. Large, left inguinal hernia; reducible, complete, acquired, indirect, of 9 years' duration, following a fall when the patient slipped and abducted the left leg, at which time he noticed a severe pain in the groin, and a few hours later, when going to bed, he noticed a swelling, which increased on standing. He has worn a truss ever since. The opening into the abdomen, through which the hernia protruded, was 3 cm. in diameter. Operation 8-10-'96, Bloodgood; ether. The subcutaneous fat was very thick, at least 4 cm. The sac was very large, but walls thin. It contained omentum and colon. The colon being adherent to the neck of the sac, the sac was closed at a point below the adhesions between it and the colon, no attempt being made to cut the adhesions. Veins large, excised. Muscle thick. Wound closed with silver wire, 2 above and five below the cord. Healing p. p. Highest temperature 102°. Very slight induration of the epididymis, which completely disappeared before the patient left the hospital, at the end of 24 days. Although the patient was a very stout, flabby man and a beer-drinker, no abdominal distention or colic followed the operation.

Note.—In this case, as the patient was very stout, of sedentary habits, and a beer-drinker, he was advised to diet and abstain from alcohol for 6 weeks before the operation, which he did. The operation was a difficult one on account of the thickness of the subcutaneous fat. This case also demonstrated the importance of the division of the aponeurosis of the external and internal oblique muscle before the isolation and excision of the sac. On opening the sac in this case the omentum and colon were easily reduced, but the colon could not be completely reduced, due to the adhesions between it and the peritoneum of the neck of the sac. The peritoneum of the sac at its neck seemed to be continuous with the peritoneum of the colon, as if the sac was a portion of the mesocolon. It was considered unwise to attempt the dissection of the colon from the neck of the sac, nor was there any indication for it, but the sac was closed at a point a little beyond the neck. We have met with two other such cases (Group I, Case 180, and Group II, Case 7).

February and June 1897, patient writes that the result is a perfect

one. September 1897, 1 year, physician reports the patient well, the wound solid and a hydrocele, which gives no discomfort. December 1898, 2 years, letter, well.

Case 160. Perfect result; last examination October 1898, 2 years. Small hydrocele followed operation; veins excised.

Surgical No. 5928. M. W. C., æt. 28; motorman. Small, right inguinal hernia; reducible, complete, acquired, indirect, of 6 years' duration, following heavy lifting. At first the rupture was about the size of a walnut, but it has gradually increased in size until now it is about the size of a hen's egg. He has worn a truss at intervals for 6 years. The hernia gives him a good deal of discomfort and pain. On admission to the hospital the hernia was reduced, and on examination the ring on this side was but slightly larger than the other and there was no impulse on coughing. A number of examinations were made during the 2 days before the operation, but no evidence of hernia could be demonstrated. The patient insisted on the correct history and on operation. Operation 17-10-'96, Bloodgood; ether. Sac small. About midway between the neck and apex there was a constriction, the diameter of which was not more than 5 mm., producing an hour-glass sac. Veins excised. Wound closed with silver wire, 1 above and 3 below the transplanted cord, most of which included the divided internal oblique muscle. Healing p. p. Highest temperature 101°. Very slight induration of the epididymis, which completely disappeared at the end of 3 weeks.

Note.—This case clearly demonstrates the fact that a patient may have a definite, acquired hernial sac, which, when empty, gives no evidence of its presence.

February 1897, 4 months, examination, perfect result, external ring closed, testicle normal. September 1897, examination, 11 months, wound solid, testicle and epididymis normal, very small hydrocele, perfect result. February 1898, 1 year 4 months, examination, perfect result, hydrocele no larger. October 1898, 2 years, examination, wound solid, hydrocele smaller.

Case 161. Perfect result; last examination March 1897, 4 months; last report (by physician) February 1898, 1 year 3 months. Small hydrocele followed operation; veins excised.

Surgical No. 6043. W. P., æt. 44; carpenter. Small, right inguinal hernia; reducible, incomplete, acquired, indirect, of two months' duration, following heavy lifting. Operation 27-11-'96, Finney; ether. Veins large, excised. Wound closed with silver wire, 2 above and 4 below the transplanted cord. Sac was not opened. The internal oblique muscle was thick and after its division was included by two of the sutures below the cord. *Operator wore gloves.* Healing p. p. Highest temperature 101°. Following the operation there was some slight swelling of the testicle and induration of the epididymis, which disappeared within two weeks. March 1897, examination, 4 months, wound solid; there is a very small hydrocele on the right side, which may have been present before the operation; the stump of the ligated veins cannot be felt, varicocele also cured, perfect result. September 1897, letter from physician, perfect re-

sult, testicle normal. February 1898, letter, 1 year 3 months, well, no mention of a hydrocele.

Case 162. Perfect result; last examination February 1898, 1 year 2 months. Small hydrocele followed operation; veins excised.

Surgical No. 6044. F. R., aet. 24; laborer. Small, left inguinal hernia; reducible, incomplete, acquired, indirect, of two years' duration, of slow formation. No history of strain or traumatism. Patient wears a truss with comfort, but wishes to be cured of the hernia. Operation 25-11-'96, Bloodgood; ether. Veins small, excised. Wound closed with silver wire, one above and three below the transplanted cord. The divided internal oblique muscle was thick. Operator wore gloves. Healing p. p. Highest temperature 100.6°. No swelling of the testicle or induration of the epididymis followed the operation. The stump of the ligated veins was situated under the skin over the pubes and could not be felt in the scrotum. Examination June 1897, 7 months, wound solid; the external ring just admits the little finger, behind which the firm conjoined tendon can be felt; testicle and epididymis normal except a very small hydrocele, perfect result. September 1897, 11 months, letter from physician, perfect result, hydrocele not noticed. February 1898, 1 year 2 months, examination, perfect result, hydrocele no larger.

Case 163. Perfect result; last examination August 1897, 8 months; last report (letter) August 1898, 1 year 8 months.

Surgical No. 6063. B. M., aet. 35; farmer. Small, right inguinal hernia; reducible, incomplete, acquired, indirect, of 9 months' duration, following a strain while lifting a heavy bag of oysters. Has not worn a truss. Operation 3-12-'96, Bloodgood; ether. Veins small, excised. Wound closed with silver wire, one above and 3 below the transplanted cord; 3 interrupted catgut sutures in the aponeurosis of the external oblique. The internal oblique muscle was thick. Sac small, excised; closed with silk. Healing p. p. Highest temperature 100.2°. Following the operation there was very slight induration of the epididymis, but no swelling of the testicle. Patient suffered from nausea and vomiting for 5 days. Examination January 1897, one month, wound solid, testicle and epididymis normal, perfect result. August 1897, examination, 8 months, perfect result, testicle normal. August 1898, letter, 1 year 9 months, perfect result.

Case 164. Perfect result; last examination August 1897, 8 months; last report (by physician) August 1898, 1 year 9 months. Conjoined tendon obliterated.

Surgical No. 6108. L. S., aet. 41; iron-worker. Medium, right inguinal hernia; reducible, incomplete, indirect, acquired. Also hydrocele on both sides. Hernia of 4 years' duration, following heavy lifting. Has not worn a truss. Operation 18-12-'96, Finney; ether. Veins small, excised. Wound closed with silver wire, one above and 5 below the transplanted cord, approximating all the available tissues well down to the pubic bone,

because the conjoined tendon was obliterated. Operator wore gloves. Healing p. p. Highest temperature 101. Very little induration of the epididymis followed the operation; 12-12-'96, under cocaine, through an incision in the scrotum, the sacs of both hydroceles were excised and the wound closed. Very slight swelling of the testicles followed the operation. March 1897, examination, 2½ months, wound solid, external ring closed, no recurrence of the hydroceles, the left epididymis was slightly indurated, perfect result. August 1897, examination, 8 months, wound solid, the external ring admits the little finger, which meets firm tissue, very slight impulse, no recurrence of the hydrocele, left epididymis still indurated, testicles normal, a perfect result. August 1898, 1 year 9 months, letter (physician), perfect result.

Case 165. Perfect result; last examination August 1897, 7 months; last report (letter) August 1898, 1 year 7 months.

Surgical No. 6150. O. K., aet. 14; schoolboy. Small, right inguinal hernia; reducible, incomplete, acquired, indirect, of 3 months' duration. Hernia became irreducible a few hours before patient was admitted to the hospital, but was easily reduced on admission. Operation 4-1-'97, Bloodgood; ether. Veins small, excised. Wound closed with silver wire, one above and three below the cord. The sac was small, but had a constriction in its upper third. The divided internal oblique muscle was thick. The external ring was not completely closed because the conjoined tendon was firm and wide. Healing p. p. But very slight induration of the epididymis and swelling of the testicle followed the operation, which disappeared in a few days. February 20, 1897, examination, one month, wound solid, testicle and epididymis normal except a very small hydrocele containing perhaps 10 cc. of fluid, which formed since the operation. August 1897, examination, 7 months, perfect result, hydrocele has disappeared, testicle normal. August 1898, letter, well, 1 year 7 months.

Case 166. Perfect result; last examination February 1898, 1 year 1 month. Direct hernia; conjoined tendon firm but narrow.

Surgical No. 6161. Wm. H. D., aet. 56; collector. Medium, right inguinal hernia; direct, reducible, incomplete, acquired, of 12 years' duration, following traumatism. Patient has worn a truss off and on for 10 years. Operation 6-1-'97, Young; ether. Veins small, excised. Wound closed with silver wire, one above and five below the transplanted cord. The internal oblique muscle was thick and was included in most of the sutures below the cord. All the available tissues were sutured well down to the pubic bone. The sac was not opened, but the bulging of the peritoneum was situated between the deep epigastric vessels and the conjoined tendon. The conjoined tendon was firm but not very broad; for this reason more sutures were used in approximating the tissues at the situation of the external ring. Healing p. p. Highest temperature 100.4°. No induration of the epididymis or swelling of the testicle followed the operation. May 1897, examination, 4 months, wound solid, perfect result. August 30, 1897, examination, perfect result, testicle normal, 8 months. February 1898, examination, 1 year 1 month, perfect result.

Case 167. Perfect result; last examination June 1899, 2 years and 5 months. Small hydrocele; veins excised.

Surgical No. 6179. C. R. M., æt. 25; student. Small, right inguinal hernia; reducible, complete, acquired, indirect, of 24 years' duration. Noticed since one year of age. Has given very little discomfort. Patient has not worn a truss. Operation 11-1-97, Cushing; ether. Veins excised. Wound closed with silver wire, one above and four below the transplanted cord. The internal oblique muscle was thick and was included by two of the lower sutures. The conjoined tendon was wide and firm; for this reason the external ring was not completely closed. Sac small, excised; closed with silk. Healing p. p. Highest temperature 100.3°. Very slight swelling of the testicle and induration of the epididymis followed the operation, lasting only a few days. March 1897, examination, wound solid, testicle and epididymis normal; a few cc. of fluid in the tunica vaginalis of the right testicle, which seems to have formed since the operation. August 1897, examination, 7 months, perfect result, hydrocele larger.

Case 168. Recurrénce; last report (letter) June 1899, 2 years and 5 months. Conjoined tendon obliterated; usual suture, healing per primam.

Surgical No. 6197. J. McP., æt. 54; blacksmith. Right and left inguinal herniae; reducible, incomplete, acquired, indirect. On the left side the hernia is small; on the right side, medium. Herniae gave very little discomfort and patient has not worn a truss. Herniae of 35 and 20 years' duration. Operation 23-1-97, Halsted, both sides. On both sides the veins were excised; on the right side the cord was not transplanted; on the left side the cord was transplanted. Both wounds were closed with silver wire. On the right side the sac was adherent and the dissection difficult; on the left side the sac was small and the operation not difficult. On both sides the internal oblique muscle was thick and could be transplanted. Both conjoined tendons were obliterated. Healing p. p. Highest temperature 103°, on the third day, caused most likely by a haematoma in the scrotum. There was no swelling of the testicle or induration of the epididymis on the left side, but immediately after operation the right side of the scrotum became very much swollen, the swelling extending up above the pubes. There was ecchymosis of the skin on the right side of the scrotum and penis, extending into the groin (every evidence of hemorrhage from the stump of the veins near the testicle). At the end of two weeks the swelling had disappeared, leaving the testicle, epididymis and cord an indurated mass pyriform in shape, in which none of the structures could be differentiated.

March 1897, 1½ months after operation, examination, both wounds solid, the left testicle and epididymis normal except a very small hydrocele which has formed since operation; there is distinct atrophy of the right testicle. September 1897, 8 months, the patient writes that the hernia has recurred on the left side.

Note.—The swelling of the testicle and epididymis on the right side case was most marked. There was every evidence that the scrotal swelling was due to hemorrhage, because there was, in addition, extensive ecchy-

mosis of the skin of the scrotum. This case demonstrates the danger of excising the veins where the sac is very adherent and the operation a difficult one. The operation on the right side in this case, in which the cord was not transplanted, is also included in Group II, Case 11.

Case 169. Perfect result; last report (by physician) June 1899, 2 years and 4 months.

Surgical No. 6217. C. Z., aet. 26; laborer. Medium, right inguinal hernia; reducible, complete, acquired, indirect, of 6 months' duration, following heavy lifting. Has worn a truss a week, which had given so much discomfort that he desired to be operated upon. Operation 1-2-'97. Bloodgood. Veins small, excised. Wound closed with silver wire, one above and three below the transplanted cord; interrupted catgut sutures in the aponeurosis. The sac was large, but there were no adhesions; contents: omentum, which was reduced without difficulty. The conjoined tendon was wide and firm; for this reason the external ring was not completely closed. Operator wore gloves. Healing p. p. Highest temperature 102°—cause, acute urethritis. Some induration of the epididymis and swelling of the testicle followed the operation, which disappeared four days after operation, and seemed to be due to fluid in the tunica vaginalis. When the patient was discharged from the hospital, 3½ weeks after operation, the testicle was still slightly swollen.

Note.—In this case the sac was not adherent and the veins were most carefully excised after the method described in this paper, but following the operation the swelling of the testicle and the induration of the epididymis were more marked than in any of the other 45 cases in which this method of excision of the veins has been practiced, but in this case the swelling did not come on until the fifth day and it seemed to be distinctly due to the formation of a hydrocele, and not to epididymitis.

August 1897, 6 months, report from physician, perfect result, testicle normal.

Case 170. Perfect result; last examination August 1898, 1 year 6 months. Small hydrocele; veins excised.

Surgical No. 6280. C. H. M., aet. 39; butcher. Very large, right inguinal hernia; reducible, complete, indirect, acquired, of 15 years' duration, of slow formation, following heavy lifting. Has worn a truss for 8 years, but has never been able to get one to fit him with comfort. Suffered from an attack of strangulation 7 years ago. Operation 26-2-'97, Finney. Veins small, excised. Wound closed with silver wire, one above and four below the transplanted cord. Sac contained adherent omentum, which was excised, requiring 20 ligatures. The sac itself was not adherent to the surrounding tissues. The internal oblique muscle was not very thick and was included in only one of the sutures below the transplanted cord. The subcutaneous fat was very thick and was the only complication of the operation. The vas deferens was handled a good deal during the operation and its mesentery torn. Healing p. p. Highest temperature 101°. Following immediately after the operation there was a good deal of swelling of the testicle, which disappeared after a few days, leaving

the testicle, epididymis and cord indurated and matted together, so that the different parts could not be differentiated; this was rapidly disappearing when the patient left the hospital, in 3½ weeks.

Note.—This case also demonstrates the danger of a marked epididymitis following the operations for large herniae if the veins are also excised.

August 1897, examination, 6 months, perfect result, the epididymis is still slightly indurated and there is a small hydrocele, no atrophy of the testicle. August 1898, examination, 1 year 6 months, perfect result, no change in hydrocele and epididymis.

Case 171. Perfect result; examination October 1898, 1 year 7 months. Hydrocele followed operation; veins excised.

Surgical No. 6304. G. N. K., aet. 49; blacksmith. Small, right inguinal hernia; reducible, incomplete, acquired, indirect, of 4 years' duration, following immediately after an injury in the groin. Although patient has worn a truss, the hernia has given him so much pain that he has been unable to work as a blacksmith for 4 years. Operation 3-2-'97, Bloodgood. Veins small, excised. Wound closed with silver wire, 2 above and 4 below the transplanted cord. Sac small, no adhesions, excised; closed with silk. The internal oblique muscle was thick and was included in 2½ of the sutures below the cord. In passing the deep suture above the cord, the stump of the ligated veins was injured; for this reason the internal oblique muscle was divided 2 cm. further upward; the bleeding stump was found and re-ligated after being drawn out 3 cm. On account of this more extensive division of the muscle, 2 sutures were placed above the transplanted cord. In passing the lowest suture the stump of the ligated veins near the testicle was also injured, the injury was recognized by the bleeding, the stump was found and re-ligated below the point of injury. Healing p. p. Highest temperature 100°. Following the operation there was absolutely no swelling of the testicle nor induration of the epididymis. September 1897, 7 months, letter from physician and patient, wound solid, a fair-sized hydrocele has formed since operation, which gives some discomfort, patient works hard and has resumed his occupation as a blacksmith, which he had given up for four years. October 1898, 1 year and 7 months, examination, wound solid, testicle normal except a small hydrocele which gives no discomfort.

Case 172-173. Perfect result; last examination April 1897, 1 month since operation. Conjoined tendon obliterated.

Surgical No. 6305. T. D., aet. 38; bookbinder. Large right and small left inguinal herniae; reducible, incomplete. On the right side direct; on the left side indirect. Operation 9-3-'97, Bloodgood. Right side (direct hernia) sac excised; veins large, excised. Wound closed with silver wire, 2 above and 6 below the transplanted cord. These 6 sutures below the cord included all the available tissue down to the pubic bone; the last two sutures were made to include the sheath of the rectus; this was done because the conjoined tendon was obliterated. The internal oblique muscle was not very thick and was included by two only of the six sutures below the

cord. Left side (indirect hernia) no distinct sac; peritoneum was not opened. Veins large, excised. Wound closed with silver wire, 3 above and 5 below the cord. The last suture included the sheath of the rectus. These additional sutures were used because the conjoined tendon was obliterated. The internal oblique muscle was divided and was of the same value as on the right side. Healing p. p. Highest temperature 101°. Absolutely no swelling of the testicle nor induration of the epididymis followed the operation. April 25, 1897, 1 month, examination, both wounds solid, both testicles normal, perfect result.

Case 174. Partial recurrence in the upper angle of the scar. Healing per primam. Last examination June 1899, 2 years and 4 months after operation.

Surgical No. 6348. N. F., aet. 41; scissors grinder. Small, left inguinal hernia; reducible, acquired, indirect, incomplete, of 4 years' duration, of slow formation, no history of injury or strain. Patient wore a truss for 2 years. Operation 10-3-'97, Garrett. *Veins not excised.* Wound closed with silver wire, 3 above and 4 below the transplanted cord. Sac small, excised; closed with silk. Divided internal oblique muscle was thick and could be transplanted. In this case the division of the muscle was carried out further than usual, and it was found that to transplant the cord up to the apex of the angle of the division would place it in a position of too much tension; for this reason it was brought out between the third and fourth sutures. The conjoined tendon was wide and firm. Healing p. p. Highest temperature 101°. Absolutely no swelling of the testicle nor induration of the epididymis followed the operation. June 1897, examination, wound solid, external ring closed, testicle normal, perfect result; this patient suffered from slight bronchitis for a few days after operation. August 1897, examination, five months, wound solid, testicle normal, no bronchitis. November 28, 1897, nine months, examination, 1.5 cm. from the upper end of the incision at the position of the transplanted cord there is an opening which just admits the tip of the little finger. On standing and coughing there is a slight impulse and bulging. The remainder of the wound is absolutely solid. Silver sutures are not palpable. Before the appearance of this bulging the patient experienced a dull pain in the wound. He has noticed it about two months. August 1898, examination, no change. June 1899, examined, no change.

Case 175. Perfect result; last report (by physician) November 1898, 1 year 8 months.

Surgical No. 6379. P. MacF., aet. 14; schoolboy. Small, right inguinal hernia; reducible, complete, acquired, indirect, of 8 months' duration, cause unknown. Has been unable to get a truss which would keep the hernia reduced. Operation 20-3-'97, Bloodgood. Veins small, not excised. Wound closed with silver wire, one above and four below the cord. Sac small, not adherent, excised; closed with silk. The sac in this case, after the division of the aponeurosis of the internal oblique muscle and the fascia, was opened into at once, cut across, and the peritoneal cavity closed with silk, after which the sac was rapidly separated from the

cord from above downwards. Internal oblique muscle thick, conjoined tendon wide and firm. Healing p. p. Highest temperature 100.5°. Very slight swelling of the testicle and very slight induration of the epididymis, with some tenderness, followed the operation and lasted 3 days. November 1898, 1 year 8 months, letter from physician, perfect result, testicle normal in size.

Case 176. Partial recurrence along the transplanted cord. Second operation in 9 months (Group I, Case 206).

Surgical No. 6455. F. T., aet. 30; bartender. Medium, right inguinal hernia; reducible, complete, acquired, indirect, of 18 years' duration, following heavy lifting. Has worn a truss for 10 years. Operation 21-4-'97, Bloodgood. Veins not excised. Wound closed with silver wire, one above and three below the transplanted cord. Operator wore gloves. After the division of the aponeurosis, the internal oblique muscle and the fascia, the sac was immediately opened, cut across, and the opening into the peritoneal cavity closed with silk. The remainder of the sac was then rapidly dissected from the cord from above downwards. The internal oblique muscle was thin, the outer border of the conjoined tendon was included by the last suture; the conjoined tendon was wide and firm; for this reason the external ring was not completely closed. Healing p. p. Highest temperature 101°. But very slight swelling of the testicle and tenderness followed the operation, lasting but a few days. For notes on the recurrence and second operation see Case 206, Surgical No. 7150.

Case 177. Perfect result; last report (by physician) August 1898, 1 year 4 months.

Surgical No. 6482. C. F. W., aet. 21; baker. Medium, right inguinal hernia; reducible, complete, acquired, indirect, of 3 years' duration. No history of strain or injury. Of slow formation. A truss did not retain the rupture, and the patient has suffered a good deal of pain in the groin, which pain has frequently prevented his working. Operation 29-4-'97, Bloodgood. Veins not excised. Wound closed with silver wire, one above and three below the transplanted cord, with interrupted catgut in the aponeurosis of the external oblique. Operator wore gloves. Operation not difficult. Sac had thin walls. Opening closed with silk. Divided internal oblique muscle thick. Conjoined tendon wide and firm and included by the last suture; for this reason the external ring was not completely closed. Healing p. p. Highest temperature 101°. Absolutely no swelling of the testicle nor induration of the epididymis followed the operation. October 1897, 6 months, report from physician, perfect result. August 1898, letter, well.

Case 178. Perfect result; last examination June 1899, 2 years and 1 month. Outer border of the conjoined tendon extended to the deep epigastric vessels; epigastric vein injured by the needle.

Surgical No. 6515. J. M., aet. 21; storekeeper. Medium, right inguinal hernia; reducible, complete, acquired, indirect, of 18 years' duration. Has

not worn a truss. Operation 8-5-'97, Bloodgood. Veins not excised. Wound closed with silver wire, one above and four below the transplanted cord; interrupted catgut sutures in the aponeurosis. Operator wore gloves. The conjoined tendon was wide and firm, and its outer border extended to the deep epigastric vessels. In this case the last two sutures were made to include the conjoined tendon. In passing the first of these two sutures one of the deep epigastric veins was injured by the needle when it was made to catch the outer border of the conjoined tendon; the haemorrhage was easily checked, but this accident demonstrates that when this tendon is wide and its outer border extends to the deep epigastric vessels, great care must be used to avoid injury to these vessels when the needle is made to catch the outer border of the tendon. The sac in this case was small and the treatment was the same as that described in Case 176. Healing p. p. Highest temperature 100.5°. Very little swelling and tenderness of the testicle followed the operation, which lasted only a few days. No evidence whatever of any haemorrhage from the deep epigastric vessels. The external ring in this case was not completely closed because of the strength and width of the conjoined tendon. September 1897, examination, 4 months, wound solid, external ring closed, silver suture not palpable, testicle normal.

*June 1897 to June 1898.*

Case 179. Perfect result; last examination September 1898, 1 year 3 months.

Surgical No. 6589. J. A. R., aet. 25; mechanic. Medium, right inguinal hernia; partly irreducible, complete, congenital, of 3 years' duration, following a strain while dismounting from his horse. The hernia has been partly irreducible for some months, and patient has had a number of attacks of pain, nausea and vomiting. Operation 3-6-'97, Bloodgood. Veins small, not excised. Wound closed with silver wire, one above and three below the transplanted cord, continuous catgut in the aponeurosis above and below the cord. Operator wore gloves. In this case, after the division of the aponeurosis of the external oblique and internal oblique muscle and the coverings of the sac, the sac was immediately opened; it contained omentum, which was not adherent. The omentum was partly irreducible because the mass in the lower part of the sac was indurated and matted together, and too large to be reduced through the neck of the sac. This mass of omentum was, however, at the operation easily reduced after enlarging the opening into the peritoneal cavity. The sac was then cut across, and the opening into the peritoneal cavity closed with silk; the remainder of the sac was then carefully dissected from the cord down to the testicle, leaving only that portion of the sac which covered the testicle (congenital hernia). During this dissection the testicle had to be drawn out of the scrotum. The conjoined tendon was wide and firm; its outer border extended almost to the deep epigastric vessels. On closing the wound the conjoined tendon was included by the last suture. The divided internal oblique muscle was thick and was included by 2 of the 3 sutures below the cord. On account of the width of the conjoined tendon the external ring was not completely closed, and 3 only

instead of 4 sutures were used in closing the wound below the transplanted cord. Healing p. p. Highest temperature 100°. Following the operation the testicle became slightly swollen and was tender for 2 days. There was very little, if any, induration of the epididymis. September 1897, 3 months, examination, wound solid, testicle and epididymis normal, perfect result, no evidence of hydrocele. September 1898, examination, perfect result, the testicle is normal.

Case 180. Perfect result; last examination June 1899, 2 years. Sac contained the sigmoid colon.

Surgical No. 6583. G. T. P., aet. 29; painter. Medium, left inguinal hernia; reducible, complete, indirect, congenital (?), of 4 years' duration, following a strain. Has worn a truss except for the last 3 months. Hernia gives very little discomfort. Operation 9-6-'97, Bloodgood. Veins small, not excised. Wound closed with silver wire, one above and three below the transplanted cord. A few interrupted catgut sutures in the aponeurosis of the external oblique muscle. Operator wore gloves. In this case the subcutaneous fat was very thick, and there was a good deal of properitoneal fat in the inguinal canal about the sac and cord. After the division of the aponeurosis of the external oblique and internal oblique muscle and the coverings of the sac, a very rare and interesting condition was found: The external surface of the sac was made up of very vascular fat, between which in a few places one could see the thin peritoneum, which, if placed in the proper light, was transparent, and when so placed one could see shining through the distinct longitudinal band of the colon and small masses of fat, which, after opening the sac, proved to be the appendices epiploicae. The operator recognized that he was dealing with one of those rare left inguinal herniae, in which the sac contained the colon. In order to demonstrate without doubt the exact condition, the peritoneal cavity was opened into through the divided internal oblique muscle, and it was found that the sac contained the colon and that its wall was the mesocolon. The opening was closed with a continuous suture of fine black silk, and the sac and its contents were reduced and the wound closed. In this case also the conjoined tendon was wide and firm and was included by the last suture and the external ring was not completely closed. Healing p. p. Highest temperature 100°. No discomfort. Absolutely no swelling of the testicle nor induration of the epididymis followed the operation. (See also Case 7, Group II, and Case 159, Group I.) August 1897, examination, 2 months, perfect result, testicle normal. January 1898, examination, 7 months, wound solid, testicle normal.

Case 181. Perfect result; last examination November 1898, 1 year 4 months.

Surgical No. 6480. Wm. G., aet. 32; driver. Small, left inguinal hernia; reducible, incomplete, acquired, indirect. Operation 7-6-'97, Bloodgood. Veins small, not excised. Wound closed with silver wire, one above and four below the cord. Interrupted catgut in the aponeurosis. Operator wore gloves. The subcutaneous fat was very thick and the inguinal

canal was filled with properitoneal fat. The sac was small, not adherent, walls very thin and contained non-adherent omentum, which was reduced. The sac was opened after the division of the aponeurosis of the external oblique and internal oblique muscles and their coverings, the omentum reduced, the sac cut across, the opening into the peritoneal cavity closed with silk, and the remainder of the sac then dissected from the cord from above downwards. The divided internal oblique muscle was thick and wide, and was included by two of the lower 4 sutures. The conjoined tendon, although firm, was narrow; it was included by the last 2 sutures and the external ring was completely closed well down to the pubic bone because of the condition of the conjoined tendon. Healing p. p. Highest temperature 100°. Absolutely no swelling of the testicle nor induration of the epididymis followed the operation. December 1897, examination, perfect result, 6 months, testicle normal.

Case 182. Perfect result; last examination August 1898, 1 year 2 months.

Surgical No. 6616. Wm. H. U., aet. 57; engineer. Medium, right inguinal hernia; reducible, complete, acquired, indirect, of 12 months' duration. Has worn a truss since the rupture was first noticed. The truss gives a good deal of discomfort, and the patient since the appearance of the hernia has suffered a good deal from attacks of indigestion. Operation 10-6-'97, Bloodgood. Veins not excised. Wound closed with silver wire, one above and three below the transplanted cord; interrupted catgut in the aponeurosis. Operator wore gloves. The subcutaneous fat was very thick. The sac was of medium size and empty, and was very adherent to the entire length of the cord and to the testicle. In this case the new method of the removal of the sac was also employed with great satisfaction. The dissection of the sac from above downwards could be done with greater ease. To remove the adherent sac from the testicle the latter had to be drawn out of the scrotum. The internal oblique muscle was thick and was included in 2 of the 3 lower sutures. The conjoined tendon was wide and firm and was included by the last suture; for this reason the external ring was not completely closed. Healing p. p. Highest temperature 102°, due to slight bronchitis. Following the operation the testicle became slightly swollen and tender; there was also slight induration of the epididymis, due without doubt to the manipulation necessary to excise the sac. November 1898, 5 months, examination, wound solid, external ring admits the tip of the index finger, testicle normal, perfect result, suture not palpable. August 1898, examination, perfect result, general health excellent.

Case 183. Perfect result; last report (letter) June 1899, 1 year and 11 months.

Surgical No. 6595. C. T. H., aet. 20; clerk. Small, left inguinal hernia; reducible, incomplete, acquired, indirect. Also a large varicocele. Hernia of 7 years' duration, following a strain. Varicocele of 2 years' duration; within the last few months it has become very large. Patient also has a fibro-adenoma of the right breast. Operation 6-7-'97, Bloodgood. Veins

large, excised. Wound closed with silver wire, one above and three below the transplanted cord; interrupted catgut in the aponeurosis. Operator wore gloves. There were a good many adhesions between the subcutaneous fat and the aponeurosis of the external oblique. After the division of the aponeurosis, the internal oblique muscle and the coverings of the sac, the sac, which was small, was opened into at once and its non-adherent omental contents reduced; the sac was then cut across and the opening into the peritoneal cavity closed with silk; the remainder of the sac was then removed with the veins as described in this paper. The mesentery of the cord and its small vascular constituents were carefully preserved. The internal oblique muscle was thick and was included in 2 of the 3 sutures below the cord. The conjoined tendon was wide and firm and was included by the last suture; for this reason the external ring was not completely closed. Healing absolutely p. p. Highest temperature 102°, a few hours after operation. For 24 hours there was absolutely no swelling of the testicle; about that time the veins of the varicocele became swollen, and with it the testicle became slightly swollen and tender; the tenderness disappeared in 2 days and the swelling in about 5 days, the result being a most satisfactory one. At the same time the right breast was completely excised and the wound closed with silver wire. November 28, 1897, letter, perfect result. 5 months.

Case 184. Perfect result; last examination August 29, 1898, 1 year.

Surgical No. 6652. G. E. R., aet. 23; clerk. Small, left inguinal hernia; reducible, incomplete, acquired, indirect, of 4 years' duration. Has given very little discomfort. Operation 6-7-'97, Finney. Veins not excised. Wound closed with silver wire, one above and three below the transplanted cord. Conjoined tendon wide and firm. Healing p. p. Highest temperature 100.8°. Very slight swelling of the testicle followed the operation, which lasted but a few days. November 1897, letter, perfect result, 4 months. August 29, 1898, examination, 1 year, wound solid, testicle normal.

Case 185. Perfect result; last examination August 1898, 1 year.

Surgical No. 6662. O. L., aet. 21; cook. Small, left inguinal hernia; reducible, complete, acquired, indirect, of 18 months' duration, following immediately after heavy lifting. Patient has suffered a good deal of pain in the inguinal region and has been almost completely incapacitated for work because of the pain and discomfort. Hernia has not been irreducible at any time. Has not worn a truss. Operation 29-6-'97, Bloodgood. Veins not excised. Wound closed with silver wire, one above and three below transplanted cord; additional sutures of interrupted catgut in the aponeurosis of the external oblique. Operator wore gloves. Sac contained omentum which was not adherent. Sac was removed from above downwards. The conjoined tendon was wide and firm, and was included by the lower half of the suture. Healing p. p. Highest temperature 101.2°. October 1897, examination, 4 months, wound solid, tes-

testicle normal. January 1898, examination, 6 months, perfect result. August 1898, examination, 1 year, perfect result.

Case 186. Perfect result; last examination June 1899, 1 year and 11 months. Small hydrocele followed operation; veins not excised but the congenital sac was *sutured* over the testicle.

Surgical No. 6709. J. H. L., aet. 21; laborer. Small, right inguinal hernia; reducible, complete, congenital, about 12 years' duration. The hernia has extended into the scrotum for two weeks. Has not worn a truss. Operation 16-7-'97, Cushing. Veins not excised. Wound closed with silver wire. The part of the sac over the testicle was sutured. The internal oblique was thin and of little value in transplantation. No note of the conjoined tendon. Healing p. p. Highest temperature 100.9°. Slight swelling of the testicle followed operation, lasting about two days. December 1897, 5 months, examination, perfect result, wound solid; the external ring admits the tip of index finger; conjoined tendon is firm; the testicle is slightly enlarged by a small hydrocele.

Case 187. Perfect result; last examination March 1899, 1 year and 7 months.

Surgical No. 6718. J. F. P., aet. 23; farmer. Medium, right inguinal hernia; reducible, complete, acquired, of ten years' duration, following a kick in the groin. Directly after the injury there was pain, and two days later tumor. Operation 12-7-'97, Cushing. Veins large, not excised. Wound closed with silver wire, one above and four below the cord. Conjoined tendon wide and firm, included in the last suture. Highest temperature 101°. Healing p. p. No swelling of the testicle followed operation. November 1897, 2½ months, examination, wound solid, external ring admits the tip of the index finger, testicle normal, sutures not palpable, perfect result.

Case 188. Lost track of since operation. Conjoined tendon obliterated.

Surgical No. 6717. C. M. L., aet. 42; printer. Large, right inguinal hernia; reducible, complete, indirect, acquired, of two years' duration. One year ago hernia was operated on. The wound suppurated and healed by granulation in three months. Four months after operation the hernia returned. There was a second operation. The wound healed p. p.; hernia returned a second time five months after operation. At the first operation for hernia the appendix was removed. Patient has two scars in the groin and a complete reducible hernia of large size on the right side. The external ring is large and the examining finger passes directly into the abdomen over the pubes. Conjoined tendon obliterated. Operation 16-7-'97, Finney. Veins very large, excised. Wound closed with silver wire. The operation was a very difficult one, due to the scar tissue. Healing p. p. Highest temperature 101°. Although the operation was a difficult one, due to the adhesions, and the veins were excised, absolutely

no swelling of the testicle nor induration of the epididymis followed operation.

Case 189. Perfect result; last examination June 1899, 1 year and 11 months since operation. Sac contained caecum and appendix.

Surgical No. 6728. C. H., aet. 48; laborer. Very large, right inguinal hernia; reducible, complete, acquired, indirect. Hernia present since childhood. Four years ago a much larger irreducible hernia on the left side was operated on (see Group IV, Case 5). Operation 12-7-97, Cushing. Veins large, excised. Subcutaneous fat thick. Sac very adherent. Contents caecum and appendix. Part of the wall of the sac was formed by the meso-caecum. Portion only of the sac was excised. The remainder was not removed, fearing injury to the vessels in the meso-caecum. Wound closed with silver wire, one above and four below the transplanted cord. The conjoined tendon, which was wide and firm, was included by the last suture. A small hydrocele near the testicle was also excised. Healing p. p. Highest temperature 102°. Following operation there was marked swelling of the testicle and induration of the epididymis, which lasted about three weeks. December 1897, examination. 4 months, wound solid, external ring almost closed, testicle normal, stump of the ligated veins palpable, epididymis slightly indurated. December 1898, examination, 1 year 3 months, wounds solid, perfect result both sides, testicle normal.

Case 190. Perfect result; last examination June 1899, 1 year and 11 months. Small hydrocele followed operation; veins excised.

Surgical No. 6744. R. J., aet. 44; laborer. Large, right inguinal hernia; reducible, acquired, indirect. Hernia of two years' duration, following fall. Patient was admitted to the hospital July 16th; the hernia being irreducible there were symptoms of strangulation. Reduction, however, was made without difficulty. Operation 20-7-97, Cushing. Veins excised. Wound closed with silver wire, one above and four below transplanted cord. The sac was adherent and there was still induration and infiltration of the tissues about the sac, the result, no doubt, of the strangulation. Following the operation there was marked swelling of the testicle and induration of the epididymis, with the formation of a small haematoma. At the end of three weeks swelling of the testicle had almost disappeared and also the induration of the epididymis. The haematoma, which corresponded with the stump of the ligated veins, was much smaller. December 1897, examination, 4 months, wound solid, external ring closed, stump of ligated veins 1 cm. in diameter, swelling of the testicle chiefly due to a hydrocele, perfect result, no discomfort, works hard.

Case 191. Slight recurrence at the position of the cord. Last report (letter) January 1899, 1 year and 6 months.

Surgical No. 6773. H. H. A., aet. 21. Very small, left inguinal hernia; reducible, incomplete, indirect, of 12 months' duration, following a strain.

Has worn a truss since. Hernia gives very little discomfort. Operation 29-7-'97, Cushing. *Veins not excised.* Wound closed with silver wire, two above and three below the transplanted cord. Sac incised, but the opening into the peritoneal cavity was not sutured. Healing p. p. Highest temperature 100°. No swelling of the testicle followed operation. April 1898, 9 months, exam. (Cushing). Slight recurrence at the position of the cord noticed three months after operation.

Case 192. Perfect result; last report (letter) October 1898, 1 year 2 months. Sac and adherent omentum removed in one piece from above downwards.

Surgical No. 6829. D. R. L., aet. 35; teacher. Medium, left inguinal hernia; complete, acquired, indirect, of 25 years' duration, following an injury of the groin. Operation 16-8-'97, Cushing. Veins not excised. Wound closed with silver wire, two above and three below the transplanted cord. The internal oblique muscle was thick and strong. Sac contained omentum, which was very adherent about the internal ring. The omentum was ligated above the neck of the sac and the sac and omentum removed in one piece from above downwards. Healing p. p. Highest temperature 101°. No swelling of the testicle followed operation. January 1898, letter, well, 5 months. October 1898, letter, perfect result, testicle normal.

Case 193. Perfect result; last report (letter) August 1898, 1 year since operation.

Surgical No. 6813. C. C. J., aet. 20; student. Small, right inguinal hernia; reducible, incomplete, acquired, indirect, of five months' duration. Has worn a truss. Operation 10-8-'97, Finney. Veins not excised. Wound closed with silver wire, one above and four below the transplanted cord. Healing p. p. Highest temperature 101°. No swelling of the testicle followed operation. November 28, 1897, 3 months, letter, perfect result, plays football at college. August 1898, letter, well.

Case 194. Perfect result; examination October 1898, 1 year.

Surgical No. 6895. E. L. C., aet. 17; farmer. Small, right inguinal hernia; reducible, incomplete, congenital, hydrocele. Hernia present since six weeks of age. Operation 9-9-'97, Cushing. Veins not excised. Wound closed with silver wire, one above and five below transplanted cord. Sac was of the congenital variety; midway between the internal ring and the testicle the lumen of the sac had become obliterated. The upper portion contained the hernia, the lower portion hydrocele fluid. No suture was made of the portion of the sac left with the testicle. Highest temperature 101°. Healing p. p. Slight swelling of the testicle followed the operation. November 27, 1897, 2 months, letter from physician, perfect result. August 1898, letter, well. October 29, 1898, examination, 1 year 1 month, wound solid, testicle normal, no hydrocele.

Case 195. Lost track of since operation. Hernia of six days' duration and of immediate formation after a strain. Conjoined tendon narrow and relaxed.

Surgical No. 6847. A. M., aet. 25; negro, laborer. Large, right inguinal hernia; reducible, complete, indirect, acquired. Hernia of six days' duration and of immediate formation after a strain while lifting a heavy piece of timber. The patient states that he felt something give way in the right groin, and immediately he suffered with pain in the groin, nausea and vomiting and noticed a swelling. At the end of six hours the rupture was reduced and has not returned since. On admission to the hospital 24 hours before operation no hernia could be made out in the groin or scrotum, but the right external ring admits two fingers (2 cm. in diameter), while the left ring admits but one (1 cm.). On the right side there is marked impulse on coughing. Operation 20-S-'97, Bloodgood; ether. Veins not excised. Wound closed with silver wire, one above and three below the transplanted cord. Catgut in the aponeurosis. Operator wore gloves. After the division of the aponeurosis of the external oblique and the internal oblique muscle the peritoneum was opened above the neck of the sac. On examining the sac from above through the abdominal cavity it could be demonstrated that there was no constriction at the neck. This pouch of peritoneum, which differed very little in appearance from the rest of the peritoneum lining the abdominal cavity, extended down into the scrotum to the testicle. It was removed from above downwards after closing the opening of the peritoneal cavity. Although this sac was of but six days' duration, the dissection from the cord and surrounding tissues caused more oozing than usual. The sub-peritoneal tissue was quite vascular. The internal oblique muscle was thick and was transplanted well down to the outer border of the conjoined tendon. The conjoined tendon was narrow and quite loose. It was included by the last suture. Healing absolutely p. p. Highest temperature 100°. Following the operation there was some swelling and tenderness of the testicle and slight induration of the epididymis and some swelling of the veins. All had disappeared at the end of three weeks except a slight swelling of the veins.

Note.—The interesting point in this case was the condition of the sac, which was of but six days' duration and consisted of a pouch which extended as far as the testicle, and which had no constriction at its neck, and the presence of vascular connective tissue between the sac and the surrounding tissues, from which there was a good deal of oozing after the removal of the sac. The unusual diminution in the width of the conjoined tendon in this case may have been a predisposing cause to hernia, and its relaxed condition, produced perhaps by the strain, may have been the immediate cause of the hernia.

Case 196. Partial recurrence at the position of the cord. Second, August 1898. Conjoined tendon obliterated; rectus muscle transplanted.

Surgical No. 6855. V. C., aet. 52; railroad watchman. Very large, left inguinal hernia; reducible, complete, acquired, indirect, of fifteen years'

duration. Has never worn a truss. The hernia is only reducible when the patient lies down. Examination: After the reduction of the hernia the examining finger passes directly through the external ring into the abdominal cavity. Conjoined tendon completely obliterated. The opening measures at least  $3 \times 3$  cm. The patient is thin and of poor muscular development. He has not worn a truss because it would not keep the hernia reduced. Operation 26-8-'97, Bloodgood. Veins large, not excised. Wound closed with silver wire, one above and four below the transplanted cord.  $3\frac{1}{2}$  of the lower sutures included the transplanted rectus muscle. Operation in detail: Skin incision, division of the aponeurosis of the external oblique and the internal muscle, opening of the peritoneum above the neck of the sac, the sac was empty, the opening at the neck measured  $3 \times 2$  cm., the sac was cut across directly at its neck and the opening into the peritoneal cavity closed with silk. The large sac was then removed quickly and without difficulty from above downwards. It measured 30 cm. in length and when spread out its width was 12 cm. Wall of the sac was not very thick and not very adherent. Sac, however, was adherent to the testicle, and during this part of the dissection the testicle was drawn out of the scrotum. The vas deferens and vessels were held out of the wound with a blunt hook; the sheath of the rectus was then divided from the pubes upwards for a distance of 5 cm. After the division of the sheath the body of the rectus muscle bulged out, the outer border of the muscle was caught at three points by black silk sutures, which were used in drawing the muscle outwards and downwards during the suture. In closing the wound  $3\frac{1}{2}$  of the lower 4 sutures were made to pass through the rectus muscle and its sheath approximating them to Poupart's ligament, so that with the divided and transplanted internal oblique muscle broad surfaces of muscular tissue were approximated to Poupart's ligament throughout the entire length of the wound. In addition the aponeurosis of the external oblique muscle was approximated by catgut beneath the cord. Operator wore gloves. Healing absolutely p. p. Highest temperature 101.4°. Following the operation there was some oedema and ecchymosis of the scrotum and some swelling of the veins and slight swelling of the testicle, all of which disappeared in three weeks. There was no induration of the epididymis. Mild attack of bronchitis followed operation. November 28, 1897, letter, perfect result. December 5, 1898, 2 months, letter, perfect result. August 26, 1898, 1 year, readmitted for second operation (Surgical No. 8037). There is a small bulging at the position of the cord and the opening admits the index finger. At the second operation the veins were found to be very large. The rectus muscle was in its place and the lower angle of the wound was absolutely solid (see page 499). June 1, 1899 (letter), perfect result since second operation.

Case 197. Perfect result; last examination December 1897,  $2\frac{1}{2}$  months. Small hydrocele followed operation; veins not excised. Letter November 1898, 1 year and 2 months.

Surgical No. 6906. A. S. S., aet. 21; railroad hand. Medium, right inguinal hernia; reducible, complete, acquired, indirect, of one and a half years' duration. Has worn a truss. Operation 9-9-'97, Cushing. Veins not excised. Wound closed with silver wire, one above and five below trans-

planted cord. Conjoined tendon firm but narrow. Included with difficulty by the last sutures. Healing p. p. Highest temperature 102°, due to *pleurisy* on the left side. No swelling of the testicle followed operation. December 1897, 2½ months, examination, wound solid, silver sutures not palpable, external ring closed, testicle normal except for a small collection of fluid in the tunica vaginalis, not observed before operation. November 1898, the patient writes that the result is a perfect one.

Case 198. Perfect result; last examination February 1899, 1 year and 4 months.

Surgical No. 7000. C. A. I., aet. 19; car-cleaner. Small, right inguinal hernia; reducible, complete, acquired, indirect, of three months' duration, following a strain. Operation 8-10-'97, Finney; ether. Veins not excised. Wound closed with silver wire, one above and four below transplanted cord. Operator wore gloves. The conjoined tendon was wide and firm, but was not included in the last suture. Healing p. p. Highest temperature 100.5°. No swelling of the testicle nor induration of the epididymis followed operation. February 1898, 4 months, examination, perfect result, wound solid, testicle normal.

Case 199. Perfect result; examination June 1899, 1 year and 8 months. Conjoined tendon narrow but firm. Urine contained albumen and casts for 7 days after operation.

Surgical No. 7005. P. McG., aet. 54; laborer. Small, right inguinal hernia; reducible, complete, acquired, indirect, of two months' duration, following heavy lifting. Operation 12-10-'97, Bloodgood; ether. Veins not excised. Wound closed with silver wire, one above and four below the cord. Operator wore gloves. The conjoined tendon was firm but narrow; was included by the last suture. Healing p. p. Highest temperature 101°. Although the patient was only 54 years of age he looked much older; subcutaneous fat was thick and anaemic; the general muscular development was poor. The hernia, however, gave him a good deal of discomfort and pain. He was very anxious to be operated on. Before operation the urine contained a few casts but no albumen. For seven days after operation the urine contained albumen and more casts. Both disappeared before the patient left the hospital at the end of three weeks. For five days following the operation the patient suffered a good deal of discomfort from abdominal colic. Tongue was coated. There was no nausea or vomiting. Highest temperature 101°. On leaving the hospital at the end of three weeks patient, however, was feeling well and did not seem to be at all pulled down by the operation and anaesthetic.

Case 200. Perfect result; examination October 1898, 1 year. Conjoined tendon narrow but firm.

Surgical No. 7018. J. W. M., aet. 37; secretary. Large, right inguinal hernia; irreducible, complete, indirect, congenital, of 30 years' duration. Truss not worn. The hernia appeared when the patient was about seven years of age, and he thinks it followed a fall. He has never worn a

truss. It has been irreducible for a number of years. There have been no attacks of strangulation. On examination the mass which descends into the scrotum measures 12 x 5 cm. Consistency is that of dough; it is dull on percussion and does not transmit light. The testicle is situated at the apex of the mass and is slightly smaller than the left testicle. The external ring cannot be palpated. The patient is quite stout. Operation 13-10-'97, Finney; ether. Veins not excised. Wound closed with silver wire, one above and five below the transplanted cord. Operator wore gloves. Subcutaneous fat was thick. The conjoined tendon was firm but narrow. It was included by 1½ of the lower sutures. In this case the aponeurosis and muscle were first divided and the peritoneal cavity opened above the neck of the sac. The sac contained a large mass of indurated omentum which was not adherent, but it was withdrawn from the sac with great difficulty. The omentum was excised, 20 ligatures being used. The stump was then reduced without difficulty through the large opening of the peritoneal cavity; the sac was divided across at the neck and the opening at the peritoneal cavity closed with silk. The sac was then removed without difficulty from above downwards. It was of congenital variety and a small portion was left of the testicle, but not sutured. During the operation the testicle was drawn out of the scrotum. After the operation there was some swelling and tenderness of the testicle, but no oedema or ecchymosis of the scrotum. Testicle was also slightly retracted. Highest temperature 101°. Healing absolutely p. p. No abdominal distention followed operation. October 1898, 1 year, examination, wound solid, testicle normal.

Case 201. Perfect result; letter June 1899, 1 year and 8 months. Emphysema of the abdominal wall, following operation.

Surgical No. 7025. H. W. S., aet. 21; merchant. Small, left inguinal hernia; reducible, incomplete, indirect, acquired, of 2½ months' duration, following a strain. Has worn a truss, which, however, gives a good deal of discomfort. Operation 20-10-'97, Bloodgood; ether. Veins not excised. Wound closed with silver wire, one above and three below transplanted cord. Interrupted catgut in the aponeurosis of the external oblique muscle. Conjoined tendon was firm but narrow; it was included by the lowest suture. The sac measured about 1 cm. in diameter and 4 cm. in length. In addition to this sac of an acquired indirect hernia there was a distinct bulging of the peritoneum to the outer side of the conjoined tendon, as if there was a beginning direct hernia. Healing p. p. Highest temperature 101°. Absolutely no swelling or tenderness of the testicle. Patient had taken ether badly and had vomited during the operation while the abdominal wound was open, and during the operation it was noticed that the tissues had already become emphysematous. 24 hours after the operation the entire left half of the abdomen was emphysematous. This completely disappeared in about a week and gave no discomfort. August 1898, the patient writes that the result is a perfect one.

Case 202. Perfect result; letter from physician June 1899, 1 year and 8 months. Excision of a very large mass of omentum.

Surgical No. 7058. J. B. T., aet. 43; farmer. Large, right inguinal hernia; reducible, but with difficulty, complete, congenital. Hernia of 16

years' duration. Patient thinks rupture formed immediately after a strain, and at the end of one month it had descended into the scrotum. For five years he wore a truss with comfort, since which time, after a number of trials, he has been unable to procure a truss which would keep the hernia reduced. Now the hernia is always present in the scrotum and when the patient retires it requires some manipulation to accomplish reduction. Five months ago hernia became irreducible and there was nausea and vomiting and a good deal of pain. His physician reduced it without an anesthetic. Operation 26-10-'97, Bloodgood: ether. Veins not excised. Omentum not adherent, excised. Wound closed with silver wire, one above and three below the transplanted cord. Conjoined tendon narrow, included by the last suture. Continuous catgut in the aponeurosis of the external oblique. Operator wore gloves. The operation was a somewhat difficult one on account of the thickness of the subcutaneous fat and the large mass of omentum which was excised. In this case, after division of the aponeurosis and the internal oblique muscle, the peritoneal cavity was opened into above the neck of the sac and the omentum which filled the sac was immediately exposed. The opening was then enlarged downwards into the lumen of the sac for 4 cm. This gave ample room to withdraw from the sac a large mass of omentum, measuring at least 20 cm. in length and 8 cm. in width at its apex. The omentum was matted together and of considerable weight. For this reason it was considered best to excise it; 25 ligatures were required and the ligated stump measured 3 x 3 cm. The stump was easily reduced through the large opening into the peritoneal cavity. As there appeared to be some slight oozing the opening into the peritoneal cavity was not closed, but packed with gauze. The sac was then divided across at the neck and removed from above downwards. It proved to be of the congenital variety. A small portion of the sac was left with the testicle but not sutured. During this dissection the testicle was drawn out of the scrotum. The gauze was then removed from the abdominal cavity and the stump of the omentum withdrawn and examined. One bleeding artery was found and tied and the stump was again replaced and the opening in the peritoneal cavity closed. The wound was then closed as described. The internal oblique muscle was thick and could be transplanted down beyond the outer border of the conjoined tendon. Healing p. p. Highest temperature 101°. Very slight swelling and some tenderness of the testicle followed operation. Directly after operation the testicle was found to be slightly drawn up in the scrotum. At the end of ten weeks the swelling had disappeared and the testicle returned to its place. August 1898, 10 months, his physician writes that the result is a perfect one and that the testicle is normal.

Case 203. Perfect result; letter from physician March 1899, 1 year and 7 months. Hydrocele of cord; phlebitis of both legs.

Surgical No. 7092. R. G., aet. 49; coalminer. Small, left inguinal hernia; partly irreducible, complete, acquired, indirect; also a small hydrocele cord, both of three years' duration, following heavy lifting. Patient thinks that during this straining he felt something burst in the left groin. He felt faint and nauseated and experienced pain in the groin. He, however, kept on with his work. In a few days he noticed a swelling

of the groin, which gradually enlarged and at the end of a few months descended into the scrotum. It has been increasing steadily in size. No attacks of strangulation. The hernia does not return completely into the abdomen when the patient lies down, nor is it completely reducible. Four months ago he was again injured in the groin, since which time the hernia has given him more pain and has not been retained by the truss. The mass which descends into the scrotum is 5 x 2 cm. in diameter, firm in consistency and dull on percussion, can be partly reduced. Testicles equal in size. Operation 8-11-97, Young; ether. Veins not excised. Wound closed with silver wire, one above and four below the transplanted cord. Operator wore gloves. After the division of the aponeurosis of the external oblique and the internal oblique muscle and the coverings of the sac, the following interesting condition was found: First, a distinct hernial sac about 3 cm. in length; then a fibrous cord 1.5 cm. in length and 5 mm. in width; then the sac containing clear fluid and lined by peritoneum about 2.5 cm. in diameter; then a second fibrous cord descending to the testicle and being intimately adherent to the tunica vaginalis about 4 cm. in length. The fibrous cord, hydrocele and the hernial sac were removed; the opening at the peritoneal cavity closed with silk. The conjoined tendon was wide and firm and was included by the last suture. Healing absolutely p. p. Highest temperature 100.5°. No discomfort except that the patient required to be catheterized for 16 days after operation. Absolutely no swelling or tenderness of the testicle nor swelling of the veins followed operation. Although the patient had to be catheterized after operation three times in 24 hours for 16 days, there was no evidence of cystitis, and on his discharge at the end of four weeks micturition was normal and but a few leucocytes were to be found in the urine. The prostate was moderately enlarged. On the 2d day patient was allowed to stand up in order to give him an opportunity to void urine, which, however, he was unable to do; this same attempt was made on the four succeeding days. On the 16th day without getting out of bed he began to void urine without difficulty. On the 27th day it was noticed that both limbs below the knees were swollen and oedematous. This began 4 days after the patient got out of bed and was associated with no rise of temperature and no pain. Four days later, when the patient was discharged, the swelling was gradually getting less. August 1898, 10 months, his physician writes that the result is a perfect one and that the swelling of the legs has disappeared.

Case 204. Perfect result; examination November 1898, 1 year. Wound opened and blood-clot irrigated out on the second day, and immediately closed again. Healing per primam. Bronchitis followed operation.

Surgical No. 7100. W. J. P., aet. 22; salesman. Large, left inguinal hernia; reducible, acquired, complete, indirect, of seven years' duration. Has worn a truss. Hernia followed a strain. He first noticed a swelling, then pain. The truss retains the hernia, which, however, descends into the scrotum when the truss is removed. Has never been irreducible. Patient has a cough and moist râles over the chest. Scarlet fever at 2 years of age (20 years ago), with symptoms of nephritis, since which time he has

had attacks of epilepsy, which had been diminished in frequency and severity by the use of bromides. Operation 11-11-97, Bloodgood; ether. Veins not excised. Wound closed with silver wire, one above and three below the transplanted cord. Catgut in the aponeurosis of the external oblique. Operator wore gloves. The conjoined tendon was wide and firm and was included by the last two sutures. The internal oblique muscle was thick and could be transplanted beyond the border of the conjoined tendon. The sac was large and empty. It was very adherent to the larger bundle of veins which accompanies the vas deferens, and during the dissection the veins were injured at two or three places. In passing the lowest suture on Poupart's ligament side an anomalous vein was injured, but the haemorrhage was checked on twisting the wire suture. Following the operation there were some ecchymoses of the scrotum and some swelling of the testicle and veins, but no tenderness. At the end of a week most of the swelling had disappeared, the testicle was about normal in size, the epididymis not indurated, but the mass of veins which extended up into the groin was indurated. The vas deferens could be easily differentiated from this mass. There had been (without doubt) thrombosis of the spermatic veins, due to injury during dissection of the sac. On the evening of the second day after operation temperature rose to 103°; on the third day, 102°; on the fourth day, 102°. There was no rise, however, in the pulse. Some discomfort was complained of in the wound. Patient had a purulent expectoration greater in amount and more cough than before the operation. There were some râles in the chest but no areas of consolidation could be made out. Leucocytosis 10,000. It was considered best to examine the wound. The wound was slightly distended. The continuous subcutaneous wire in the skin was removed. The tissues had a perfectly healthy appearance; there were about 50 cc. of blood in the wound, which coagulated at once on being exposed to the air. Coverslips, studied at once, showed no marked excess in the number of leucocytes to the number of red cells and no bacteria could be seen. For this reason the wound was irrigated with 1:1000 bichlorate, followed by salt solution and closed. The cultures at the end of 24 hours, made from the blood taken from the wound before irrigation, were sterile. The wound has healed p. p. The opening of the wound and the washing out of the blood did not influence the temperature. It remained about 102° for 2½ days longer, improving with the improvement in cough and the disappearance of the râles in the chest. Blood was found in the sputa the day after the wound was opened.

Note.—The wound in this case was opened in order to demonstrate as early as possible whether it was infected, because our observations have demonstrated that infected hernia wounds or wounds distended with blood should be opened and irrigated as early as possible after operation. If bacteria are found to be present the skin incision is left open; if the blood is free from organisms the wound is again closed.

When the patient was discharged from the hospital on the 30th day there was no swelling of testicle or epididymis. The induration of the veins was much softer and swelling had gradually decreased in size. The healing of the wound had been absolutely per primam. Bronchitis was about the same as before operation. Patient had three epileptic attacks during these 4 weeks, but none of them very severe. November 1898, 1 year since operation, examination, wound solid, testicle normal, induration of the veins has completely disappeared.

Case 205. Patient lost sight of since operation. Transplantation of undescended testicle into scrotum.

Surgical No. 7115. John F., æt. 21. Small, right, incomplete, congenital, associated with a partially undescended testicle. Hernia has always been present. During the last year it has grown larger. When the patient lies down the hernia disappears. A truss has not been worn. No attacks of strangulation. The testicle can be drawn out through the external ring but not into the scrotum. It is about one-half smaller than the left. Eight weeks before operation patient had an attack of catarrhal jaundice. His present condition is good. Operation 11-11-97, Bloodgood; ether. Veins not excised. Wound closed with silver wire, one above and four below the transplanted cord. Testicle transplanted into the scrotum, and retained by suture. During the operation the patient had tachycardia, pulse being from 120°-150° with no apparent cause. The respirations were only 24. The tachycardia disappeared within one-half hour after the ether was discontinued, pulse being 60 when the patient reached the ward and has ranged between 60 and 80 since. At the operation after the division of the aponeurosis of the external oblique and the internal oblique muscle, the peritoneal cavity was opened into above the neck of the sac. The sac was of the congenital variety and the relation of the sac to the cord is interesting to note. The cord projected into the sac, making a distinct ridge. The relation between the cord and the peritoneum of the sac being very similar to that between the mesocolon and colon. The operator has observed this anatomical relation to be always present in congenital hernia in the male, but never in acquired hernia. He has also noted this condition to be present in a few cases of hernia in the female, while in other cases the relation of the round ligament to the sac is similar to that between the cord and the acquired sac in the male. From these observations he has been led to believe that such a condition in the female is perhaps indicative of a congenital sac (see Sec. XV). In this case the sac was divided across above the neck and the opening into the peritoneal cavity closed with silk. Only a small portion of the sac was removed; the greater portion was left with the testicle and cord. The testicle and cord were then freed from all other attachments, except that between the testicle and the cavity in the scrotum, which was lined by peritoneum, continuous with that of the sac. An assistant then invaginated the base of the right side of the scrotum with a blunt artery clamp, pushing the invaginated portion up into the wound in the groin. The tunica of the testicle was then sutured with silk to the invaginated portion of the scrotum. The silver wire sutures were then introduced, one above and four below the transplanted cord, the last two sutures including the conjoined tendon, which was wide and firm. The sutures were twisted, cut and their ends bent over. Having closed the deeper wound the testicle was pushed down into the scrotum. It could be made to descend so that its upper portion was just below the pubic bone. It seemed to have no tendency to return. The skin was closed with the usual subcutaneous suture of silver wire. Healing absolutely p. p. Following the operation there has been no swelling or tenderness in the testicle. Highest temperature 100.5°. There has been no abdominal distention nor any indigestion nor return of the jaundice. Albumen was not present in the urine before or after operation. The patient made an uneventful convalescence.

Case 206. Perfect result; June 1899, letter, 7 months. Small recurrent hernia (see Case 176); rectus muscle transplanted.

Surgical No. 7150. F. T., aet. 30; bartender. Partial recurrence of a right inguinal hernia (see Group I, Case 176, Surgical No. 6455). The first operation was performed March 21, 1897, by Dr. Bloodgood. The hernia was of medium size, reducible, complete, acquired, indirect and of 18 years' duration, following heavy lifting. He had worn a truss for 10 years. At the operation the veins were not excised. The wound was closed with silver wire, one above and three below the transplanted cord. It was noted at the time of the operation that the conjoined tendon was wide and firm but that the internal oblique muscle was thin and of not much value in transplantation. The wound healed p. p. In August 1897, his physician wrote that the result was a perfect one. One month later the patient states that he noticed a little soft place and a bulging in the upper angle of the wound. This has given him no discomfort. It has not increased much in size. Examination November 19th, 1897, eight months after operation: 4 cm. from the upper end of the scar there is an opening which just admits the tip of the little finger. On standing and coughing there is a small bulging, which is perfectly reducible. The patient was advised to wear a truss. After trying the truss a day he returned to the hospital and requested operation. Operation 22-11-'97, Bloodgood. The skin incision was made larger than the previous one and extended further down into the skin over the pubes. Just beneath the skin a distinct sac was found. It consisted of peritoneum covered by scar tissue in which there was a little fat. This protrusion had broken through the wound just above the cord. It was adherent to the cord and extended a short distance downwards along the cord, holding the same anatomical relation to the cord as an oblique inguinal hernia. The opening through which the protrusion came measured about 1 x 1 cm. in diameter. The sac measured in length about 3 cm. The wound between the cord and pubes was absolutely solid. Just above the neck of this sac was the internal oblique muscle. The protrusion of peritoneum had then made its way at the position through which the cord was transplanted. It is to be remembered that it was noted at the previous operation that the internal oblique muscle was thin and not of much value in transplantation. In the dissection at the second operation no muscular tissue could be demonstrated in the scar tissue about the transplanted cord. The cord lay between the skin and the aponeurosis of the external oblique, being slightly adherent to both, but easily dissected free. Above and to the outer side of the cord the aponeurosis of the external oblique was not completely approximated. One could not with certainty tell whether this was so after the first operation or whether the protrusion of peritoneum had produced this condition. The silver wires were found in place, the suture just above and just below the transplanted cord had torn through the aponeurosis of the external oblique on the lower or Poupart's ligament side. The breaking through of the suture above the cord may have had something to do with the weakness of the wound in this position. The second operation was performed in the following manner: The aponeurosis of the external oblique was divided above the sac; the internal oblique muscle was divided for a distance of about 3.5 cm. The sac was carefully separated from the scar tissue. The peri-

tonium was opened above the neck of the sac. It was empty and there were no adhesions. The sac was divided across above the neck and the opening into the peritoneum closed with a continuous suture of fine black silk. This little pouch of peritoneum was carefully dissected from above downwards from the cord. The cord was carefully isolated from the skin and the aponeurosis of the external oblique. This dissection was not difficult. The silver wires were removed, but the wound below and the medial side of the cord were not disturbed. The rectus muscle was then exposed above the conjoined tendon by dividing its sheath from the pubic bone upwards for a distance of about 5 cm. Three black silk sutures were then placed in the muscle, traction on which drew the muscle against Poupart's ligament. The wound was closed in the following manner: The lowest suture was passed first. It approximated Poupart's ligament to the rectus muscle and the aponeurosis of the external oblique down to the pubic bone. The next suture which was passed was that just below the transplanted cord, including on the upper and medial side the aponeurosis of the external oblique, the divided internal oblique muscle and *the rectus muscle*; on the lower side the divided internal oblique muscle and the aponeurosis of the external oblique; two sutures were then passed between these. One suture was then passed above the transplanted cord, including the aponeurosis of the external oblique and the internal oblique muscle just above the point of its division. On twisting the sutures the rectus muscle was firmly approximated to Poupart's ligament and the aponeurosis of the external oblique from the arch of the pubes up to the lower and medial border of the transplanted cord, in addition to the other tissues. The aponeurosis of the external oblique was then carefully approximated with catgut sutures above and below the position of the transplanted cord. The skin wound was closed with a continuous subcutaneous suture of silver wire. Healing absolutely p. p. Highest temperature. Following operation there was some swelling of the testicle but no tenderness. This swelling was evidently due to fluid in the tunica vaginalis. On the 7th day about 15 cc. of a clear serum were aspirated. This is the first observation we have made of a hydrocele, immediately after the operation for hernia, in which the vein had not been excised. During this operation there was absolutely no traumatism to the testicle and very little, if any, to the cord.

Case 207. Perfect result; examination June 1899, 1 year and 5 months. Phlebitis of left leg followed operation. Rectus transplanted.

Surgical No. 7277. O. M. B., aet. 37; farmer. Large, left inguinal hernia; reducible, complete, acquired, indirect, of 25 years' duration, following strain. Truss worn. Operation 12-1-'98, Bloodgood; ether. Transplantation of rectus. Veins not excised. Wound closed with silver wire, 1 above, 4 below cord. Catgut in aponeurosis. Gloves worn. Internal oblique muscle good—divided. Conjoined tendon wide and firm. The rectus was transplanted, because of the size of the hernia, to strengthen the wound. Healing per primam. Phlebitis of the left leg followed operation. It began on the 7th day and was not associated with fever or leucocytosis. Leg still swollen on discharge. Absolutely no swelling of testicle or of epididymis followed operation. July 1898, 6 months, exami-

nation, wound solid, external veins closed, testicle normal, leg still swollen, September 1, 1898, letter, 8 months, well, leg much better. October 1898, examination, wound solid, testicle normal. The leg is still very much swollen.

Cases 208-209. Perfect result; examination September 1898, 8 months.

Surgical No. 7284. R. D. M., aet. 42 years; farmer. Small, right and left inguinal herniae; reducible, complete, acquired, indirect. Varicocele left side. Left side 14 years, slow formation. No truss worn. Right side 18 months, slow formation, truss worn. Operation 25-1-'98, Cushing; ether. Left side: Veins excised. Wound closed, silver wire, 2 above, 4 below cord. Internal oblique muscle good, divided. Conjoined tendon wide and firm. Right side: Ditto. Veins not excised, Gloves worn. Healing per primam. Slight swelling and induration of testicle and epididymis on left side. None on right.

Case 210. Perfect result; August 1898, letter, 6 months.

Surgical No. 7294. J. J. S., aet. 40 years; farmer. Small, left inguinal hernia; reducible, incomplete, acquired, indirect, of 12 years' duration, gradual formation, no cause. Truss worn. Small, right femoral hernia of 1 month's duration, following strain. No truss worn. Operation 20-1-'98, Young; ether. Left side: Veins not excised. Wound closed, silver wire, 1 above, 5 below cord. Gloves worn. Internal, oblique, thin, placed high, divided. Conjoined tendon narrow, weak. Lower two sutures in sheath of rectus. Sac empty. Right side: Femoral hernia. Excision of sac. Wound closed, gauze drain. Healing left, per primam; right, per primam, drain removed 11th day. No swelling or tenderness of testicle or epididymis.

Cases 211-212. Perfect result; September 1898, examination, 8 months.

Surgical No. 7305. J. K., aet. 34 years; motorman. Medium, right inguinal hernia; reducible, incomplete, acquired, indirect, of 2 years' duration, following coughing. Truss worn. Left side: Large varicocele, discomfort 3 weeks. No evidence of hernia. Operation 20-1-'98, Cushing; ether. Right side: Veins not excised. Wound closed, silver wire, 1 above, 3 below cord. Ligation of deep epigastric vessels. Internal oblique muscle fair, divided. Conjoined tendon wide and firm. Sac contained intestine, not adherent. Left side: Veins excised. Wound closed, silver wire, 1 above, 3 below cord. Conjoined tendon wide and firm. Internal oblique muscle good, divided. Hernia operation performed because of a bulging of the peritoneum, a pre-hernial stage. Healing per primam. No swelling or induration of testicle or epididymis of either side. Swelling of veins on right side. Induration of stump of veins on left side.

Case 213. Perfect result; August 20, 1898, letter, 6 months.

Surgical No. 7326. F. H. G., aet. 33 years; barber. Medium, right inguinal hernia; reducible, acquired, indirect, of 2 years' duration, follow-

ing trauma, immediate formation. Complete 5 months, following heavy lifting. Truss worn. Operation 27-1-98, Halsted; ether. Veins not excised. Wound closed, silver wire, 1 above, 4 below. Internal oblique muscle good, divided. Sac contained adherent omentum, excised. Healing per primam. Very slight swelling and tenderness of testicle and epididymis, lasting a few days. August 20, 1898, letter, well, private U. S. V. Army.

Case 214. Perfect result; September 1, 1898, letter, 8 months.

Surgical No. 7336. F. T. P., aet. 37 years. Small, left inguinal hernia; reducible, incomplete, following removal of tumor in groin (February 1894, J. H. H.). Hernia 18 months, following strain. Truss worn. Hernia took place at the position of the transplanted cord. Operation 25-1-98, Halsted; ether. Veins excised. Wound closed, silver wire, 2 above and 3 below cord. Gloves worn. Internal oblique muscle divided and transplanted. Conjoined tendon wide and firm. Healing per primam. Small subcutaneous haematoma opened 12th day. No cultures. No swelling of testicle nor induration of epididymis.

Cases 215-216. Perfect result; September 1898, 6 months, examination.

Surgical No. 7343. H. M., aet. 19 years; bricklayer. Medium, right and left inguinal herniae; reducible, complete, congenital. Right side: 10 years, following trauma, immediate formation, truss. Left side: 2 years, trauma, slow formation, no truss, atrophy of left testicle. Operation 9-2-98, Cushing; ether. Veins not excised. Wound closed, silver wire, 2 above, 3 below cord. Gloves worn. Both muscles and conjoined tendon wide and firm. Left side sac hour-glass constriction. Infantile variety. Healing per primam. No swelling of testicle or epididymis.

Case 217. Perfect result; June 1899, examination, 1 year and 8 months.

Surgical No. 7358. P. M., aet. 13 months. Large, right inguinal hernia; strangulated 3 days, incomplete, congenital, 11 months' duration. General condition excellent. Operation 28-1-98, Finney; ether. Veins not excised. Wounds closed, silver wire, 1 above, 4 below cord. Gloves worn. Sac contained caecum, omentum, appendix and blood-stained fluid. Appendix removed. No adhesions; part of sac formed by meso-caecum. No suture of sac over testicle. Healing p. p. No swelling of testicle or epididymis. September 1898, stitch abscess, wound solid.

Case 218. Perfect result; September 1898, letter, 6 months.

Surgical No. 7365. C. U., aet. 20 years; clerk. Small, left inguinal hernia; reducible, incomplete, indirect, acquired, hernia of 3 weeks' duration. Has not worn truss. Operation 3-2-98, Cushing; ether. Veins not excised. Wound closed, silver wire, 3 sutures above, 3 below transplanted cord. Operator wore gloves. Healing per primam. At the same time appendectomy for a chronic appendicitis through a second incision.

Case 219. Perfect result; June 1898, 4 months, examination; November 20, 1898, letter, 9 months.

Surgical No. 7414. R. N. C., aet. 19 years; clerk. Large, right inguinal hernia; reducible, complete, congenital, since childhood, no truss, never strangulated. Operation 16-2-'98, Bloodgood; ether. Veins not excised. Wounds closed, silver wire, 1 above, 3 below cord. Internal oblique muscle and conjoined tendon good. Dissection of sac from testicle and cord very difficult and testicle was drawn out of scrotum. Healing per primam. Swelling of testicle and epididymis and ecchymosis of scrotum 24 hours after operation. No swelling of testicle on discharge. Epididymis very hard, not much swollen. Cord extends as hard rod-size pencil upwards from epididymis. June 1898, examination, 4 months, wound solid, testicle normal. August 20 and November 1898, letter, 9 months, well.

Case 220. Perfect result; examination November 1898, 9 months.

Surgical No. 7420. F. M., aet. 32 years; ironmoulder. Large, right inguinal hernia; reducible, complete, congenital, of 19 years' duration. Truss not worn. Operation 19-2-'98, Cushing; ether. Veins not excised. Wound closed, silver wire, 2 above, 3 below cord. Gloves worn. Internal oblique muscle good, divided. Conjoined tendon wide and firm. Sac contained omentum. Adhesions cut, reduced. No suture of sac over testicle. Healing per primam; no swelling of testicle or epididymis. March 6, acute follicular tonsilitis, temperature 103° (15th day). March 14, incision small abscess in tonsil, streptococcus. April 1898, examination, 1 month, wound solid, testicle normal. August 1898, letter, 6 months, well. November 1898, examination, wound solid, testicle normal.

Case 221. Perfect result; March 1899, examination, well, 1 year.

Surgical No. 7425. J. S., aet. 53 years; baker. Small, right inguinal hernia; reducible, complete, acquired, *direct*, of a few years' duration. Truss not worn. Operation 21-2-'98, Cushing; ether. Veins not excised. Rectus muscle transplanted. Wound closed, silver wire, one above, four below cord. Internal oblique muscle divided. Conjoined tendon very narrow. Gloves. (For operation on right side see Group II, Case 15.) Healing per primam. No swelling of the testicle.

Case 222. Perfect result; November 1898, 8 months, examination. Hydrocele followed operation; veins excised, also sac of a hydrocele excised.

Surgical No. 7437. G. M., aet. 33 years; butcher. Medium, left inguinal hernia; reducible, complete, acquired, *indirect*, also left varicocele and hydrocele. Hernia 4 years, after a fall. Hydrocele 3 years 6 months. Truss worn 2 years. Last 4 months truss gives discomfort, reduction of hernia is difficult. Operation 25-2-'98, Finney; ether. Veins excised. Hy-

drocele excised, one incision. Wound closed, silver wire, three above and two below cord. Operator wore gloves. Sac contained sigmoid colon, very adherent, and omentum, which was excised. Part of sac formed by mesocolon. Healing per primam. Immediate and marked swelling of epididymis and ecchymosis of scrotum. March 14th, 1898, hydrocele tapped, 140 cc. of blood-stained fluid removed. May 24, 1898, Surgical No. 7726, operation for hydrocele, incision in scrotum, healing p. p. November 1898, examination, 8 months, wound solid, testicle enlarged, epididymis and cord still indurated.

Note.—This result demonstrated the inadvisability of excision of veins and the sac of a hydrocele at the operation for hernia.

Case 223. Perfect result; September 1, 1898, examination, 6 months; testicle normal.

Surgical No. 7445. G. F. G., aet. 30 years; machinist. Small, left inguinal hernia; reducible, incomplete, acquired, indirect, of 8 years' duration, following strain. Truss worn. Operation 3-3-98, Bloodgood; ether. Veins not excised. Wound closed, silver wire, 1 above, 3 below cord. Gloves worn. Internal oblique muscle and conjoined tendon good. Healing per primam. Absolutely no swelling of testicle or epididymis.

Case 224. Partial recurrence in the upper angle of the wound at the position of the transplanted cord, 2 months after operation. Wound suppurated. Last examination November 1898, 8 months since operation; wears a truss.

Surgical No. 7490. C. M., aet. 60 years; carpenter. Large, left inguinal hernia; reducible, complete, acquired, indirect. Hernia 51 years; truss 38 years. Complete haemorrhoids 10 years. Operation 14-3-98, Cushing; ether. Transplantation of rectus. Veins not excised. Wound closed, silver wire, one above and four below cord. Subcutaneous fat thick. Internal oblique muscle thick, divided. Conjoined tendon wide and firm. Gloves worn. Also complete excision of the rectum for haemorrhoids. Complete suppuration of the skin incision, due to superficial necrosis, 16th day. Complete healing 9 days later. No discharge of the buried silver wire. May 20, 1898, 2 months after operation, examination: in the upper angle of the wound of the position of the transplanted cord there is a distinct bulging and impulse and an opening which easily admits the index finger. November 1, 1898, examination, no change, wears a truss.

Case 225. Perfect result; September 1898, letter, 6 months.

Surgical No. 7495. H. S., aet. 33 years; motorman. Medium, left inguinal hernia; reducible, complete, congenital, of 7 years' duration, slow formation, complete in 5 years. Truss worn 2½ years, of little value. Operation 12-3-98, Halsted; ether. Veins not excised. Rectus transplantation. Wound closed, silver wire. Gloves worn. Internal oblique divided. Rectus transplanted because conjoined tendon not strong. Suture of sac over testicle. Healing per primam. Some swelling of testi-

cle, slight ecchymosis of scrotum, due to hydrocele, which almost disappeared in 2 weeks.

Case 226. Perfect result. Examination November 29, 1898, 8 months.

Surgical No. 7525. C. E. E., æt. 10 years; schoolboy. Small, right inguinal hernia; reducible, congenital, incomplete, hydrocele of sac, of 7 years' duration. Hydrocele has been tapped. Operation 22-3-'98, Cushing; ether. Veins not excised. Wound closed, silver wire. Gloves worn. Internal oblique muscle good, divided. Conjoined tendon wide and firm. A congenital sac, closed at external ring above omentum not adherent, reduced; below fluid. No suture of sac over testicle. Healing per primam. Slight swelling of testicle (due perhaps to fluid), which disappeared in 10 days.

Cases 227-228. Partial recurrence at the position of the cord, right side; perfect result, left side. Last examination December 1898, 6 months.

Surgical No. 7529. B. M., æt. 38 years; jockey. Large, right inguinal hernia; reducible, complete, acquired, indirect, of 18 years' duration, cause unknown, strangulated 2 years ago (a few hours). Large, left inguinal hernia; reducible, incomplete, acquired, direct, of 2 years' duration. Truss not worn. Operation 25-3-'98, Finney; ether. Right side: Veins not excised. Wound closed, silver wire, 1 above, 5 below cord. Subcutaneous fat thick. Conjoined tendon wide and firm. Sac contained adherent omentum, reduced. Left side: Mitchell; ether. Veins not excised. Wound closed, silver wire, 1 above, 5 below cord. Conjoined tendon wide and firm. Sac contained sigmoid colon, no adhesions. Gloves worn. Healing per primam. Slight ecchymosis of penis and scrotum. No epididymitis left side; slight right side. March 1899, examination, 1 year; no change; operation active. June 1899, examined, no change.

Case 229. Perfect result; March 29, 1899, examination, 1 year.

Surgical No. 7532. G. B., æt. 35 years; ironworker. Small, right inguinal hernia; reducible, complete, acquired, indirect, of 1 year's duration. No cause. Truss worn 8 months. Operation 26-3-'98, Hunner; ether. Veins not excised. Wound closed, silver wire, 1 above and 4 below cord. Gloves worn. Internal oblique muscle good, divided. Conjoined tendon wide and firm. Sac hour-glass constriction in centre. Healing per primam. No swelling or tenderness of testicle or epididymis.

Case 230. Perfect result; November 1898, letter, well, 8 months.

Surgical No. 7543. M. L. C., æt. 58 years; farmer. Small, right inguinal hernia; reducible, complete, indirect, acquired, of 15 years' duration, after attack of vomiting. Truss not worn. Operation 30-3-'98, Cushing; ether-chloroform. Veins not excised. Wound closed, silver wire, above and

below cord. Gloves worn. Internal oblique muscle good, divided. Conjoined tendon wide and firm. Sac contained adherent omentum, which was excised. Healing per primam. No swelling of testicle or epididymis.

Case 231. Recurrence at the position of the transplanted cord. Veins not excised. Wound healing per primam.

Surgical No. 7566. W. W., æt. 17 years; baker. Medium, right inguinal hernia; reducible, complete, acquired, indirect, of 5 months' duration. Gradual formation, no cause. Truss worn 3 months. Operation 7-4-'98, Cushing; ether. Veins not excised. Wound closed, silver wire, 1 above and 4 below cord. Gloves worn. Internal oblique muscle good, divided. Conjoined tendon wide and firm. No special reason for transplantation of rectus. Healing per primam. No swelling of testicle or epididymis. Slight tenderness of epididymis for few days. Examination July 30, 1898, four months after operation: at the position of the transplanted cord one feels with the index finger a depression, and when the patient coughs there is a slight impulse. The remainder of the wound is solid. Testicle normal. December 1898, the patient writes that the result is a perfect one. February 21, 1899, patient returns because he has noticed a bulging in the upper angle of the wound which has increased in size since the examination in July, 1898. Second operation 21-2-'99, Bloodgood; ether. The sac was situated above the large bundle of veins. The opening between the scar tissue just admitted the index finger. The transplanted rectus muscle was in place and the lower portion of the wound was solid. The large bundle of veins was ligated and excised without disturbing the remainder of the cord. Peritoneum was not opened. The internal oblique muscle was then divided, transplanted and sutured over the remaining portion of the cord, which was not disturbed. The wound healed per primam. Following the operation there was a little swelling of the testicle due to fluid in the tunica vaginalis. Examination June 1, 1899, wound solid, testicle normal.

Case 232. Perfect result; examination June 1899, 1 year and 2 months.

Surgical No. 7604. W. P., æt. 21 years; clerk. Medium, left inguinal hernia; reducible, complete, acquired, indirect, of 1 year's duration, after heavy lifting. Operation 18-4-'98, Cushing; ether. Veins not excised. Wound closed, silver wire, one above and four below cord. Gloves worn. Internal oblique muscle wide. Conjoined tendon wide and firm. Sac contained omentum not adherent, returned. Healing per primam. No swelling of testicle or epididymis.

Case 233. Perfect result; June 1899, letter, well, 1 year and 2 months.

Surgical No. 7626. J. P. S., æt. 33; engineer (mech.). Small, right inguinal hernia; reducible, incomplete, acquired, indirect, of 8 years' duration, following trauma, slow formation 6 months later after heavy lifting. Truss of no value. Operation 25-4-'98, Cushing; ether. Veins not excised. Wound closed, silver wire, 1 above, 4 below cord. Gloves worn.

Internal oblique muscle good, divided. Conjoined tendon wide and firm. Sac small, empty. Small mass of properitoneal fat excised. Healing per primam. No swelling or induration of testicle or epididymis.

Case 234. Perfect result; December 10, 1898, examination, well, 8 months.

Surgical No. 7637. J. K., aet. 37; bottler. Small, left inguinal hernia; reducible, incomplete, acquired, indirect, of 1 year's duration. Truss worn. No history of strangulation. Conjoined tendon wide, but not strong. Internal oblique and rectus muscles thick. Operation 30-4-'98, Bloodgood; ether. Rectus muscle transplanted. Veins small, not excised. Internal oblique muscle not divided, but cord transplanted. Wound closed, silver wire, three below cord, including rectus and internal oblique, and one above cord. Catgut in aponeurosis of external oblique. Operator and assistants wore gloves. Skin wound closed by Dr. Mitchell. Healing per primam. No swelling or induration of testicle or epididymis. No hydrocele. August and December 1898, examination, wound solid, testicle normal.

Case 235. Perfect result; examination June 1899, 1 year and 1 month.

Surgical No. 7660. T. H., aet. 39; fireman. Small, left inguinal hernia; reducible, complete, acquired, indirect, of 2 months' duration, no trauma, no cause known. Does not wear truss. Operation 9-5-'98, Cushing; ether. Veins not excised. Wound closed, silver wire, 1 above, 4 below cord. Gloves worn. Internal oblique muscle good. Conjoined tendon wide and firm. Sac small, contained omentum, few adhesions. Healing per primam. Slight swelling and tenderness of testicle. Acute bronchitis for several days after operation, but apparently did no harm.

Case 236. Perfect result; June 1899, examination, 1 year and 1 month; testicle normal.

Surgical No. 7676. C. W. A., aet. 21 years; laborer. Large, left inguinal hernia; reducible, complete, acquired, indirect, of 2 years' duration, following heavy lifting, of immediate formation, complete in 8 months. Large varicocele left side. Truss worn. Operation 10-5-'98, Cushing; ether. Transplantation of rectus. Veins excised. Wound closed, silver wire, 1 above, 4 below cord. Gloves worn. Internal oblique muscle good, divided. Conjoined tendon narrow and very relaxed. Rectus narrow, did not transplant as well as usual. Healing per primam. No swelling or induration of testicle or epididymis.

Case 237. Perfect result; November 26, 1898, examination, well, 6 months.

Surgical No. 7688. G. K., aet. 38 years; laborer. Recurrent, left inguinal hernia, due to the descent of the testicle. First operation, December 21, 1897 (see Group VII, Case 1). At this operation the normal testicle was placed in the abdominal cavity and the wound closed with silver wire.

The rectus muscle was not transplanted. Wound healed per primam—the patient noticed a bulging in the wound 3 months after operation. Second operation 11-5-'98, Cushing: ether. Veins not excised. Testicle replaced in scrotum. Rectus muscle transplanted. Wound closed with silver wire, one above and 4 below cord. Internal oblique muscle thick, divided. Conjoined tendon wide and firm. The testicle had pushed its way out between the outer border of the conjoined tendon and the internal oblique muscle, and accompanying the testicle a large mass of properitoneal fat. No protrusion of peritoneum. Peritoneal cavity not opened. Wound healed per primam. Following the operation there was some swelling of the testicle, and it was situated high in the scrotum just below the level of the pubes. August 20, 1898, examination, wound absolutely solid, external ring closed. The testicle has not descended any further into the scrotum and is slightly smaller than the opposite. March 1899, examination, 10 months, wound solid, atrophy of testicle.

Case 238. Perfect result; June 1899, examination, 1 year and 1 month.

Surgical No. 7722. J. J. B., aet. 36 years; machinist. Large, left inguinal hernia; irreducible (4 days), complete, acquired, indirect, of 12 years' duration, following trauma. In scrotum in 2 years. Truss not worn. Irreducible first attack, 4 days. No symptoms of strangulation. Operation 24-5-'98, Bloodgood; ether. Rectus transplanted. Veins not excised. Wound closed, silver wire, two above and three below cord. Catgut in aponeurosis of external oblique. Operator wore gloves, no irrigation. Sac contained omentum and fluid. Omentum reduced. Healing per primam. Pneumonia 8th day after operation, felt pain in the left chest through to back, on 12th day temperature rose to 102.5°. No swelling of testicle nor induration of epididymis.

Case 239. Perfect result; March 1899, 10 months, examination, testicle normal.

Surgical No. 7724. J. L. E., aet. 57 years; professor. Medium, right inguinal hernia; reducible, incomplete, acquired, direct, of 11 years' duration, no cause. Complete 2 years ago. Truss worn. (Group B.) Conjoined tendon obliterated. Operation 28-5-'98. Halsted; ether. Internal oblique muscle not divided. Rectus transplanted. Cord transplanted. Veins not excised. Wound closed, silver wire, above and below cord. Gloves not worn. Contents of sac—intestine not adherent. Ligation of deep epigastric vessels. Healing per primam. Absolutely no swelling or induration of testicle or epididymis. December 1898, examination, wound solid, testicle normal. March 1899, examination, perfect result.

Case 240. Perfect result; letter November 1898, 6 months.

Surgical No. 7727. F. C. S., aet. 31 years; laborer. Medium, right inguinal hernia; reducible, complete, acquired, indirect, of 5 years' duration, no cause. Complete in 1 week, following heavy lifting. Does not wear truss. Operation 26-5-'98. Huger; ether. Internal oblique muscle not divided. Rectus transplanted. Cord transplanted. Veins not excised.

Wound closed, silver wire, 2 above, 4 below cord, 4 below including rectus. Gloves worn. Conjoined tendon wide and firm. Rectus muscle transplanted because internal oblique muscle thin and high. Healing per primam. Slight swelling and tenderness of epididymis followed operation. Testicle and epididymis normal on discharge.

Case 241. Perfect result; January 1899, examination, 8 months.

Surgical No. 7743. S. M., æt. 29 years; tailor. Small, right inguinal hernia; strangulated 2 hours, complete, acquired, indirect, of many years' duration (possibly since birth). Complete 2 years ago; 6 months ago irreducible for a few hours. Operation 28-5-'98, Cushing; ether. Veins not excised. Internal oblique muscle not divided. Wound closed, silver wire, 1 above, 4 below cord, 4 below including rectus. Gloves not worn. Contents of sac: 6 in. intestine, congested, not adherent, 1 oz. clear fluid. Healing per primam. Absolutely no swelling of testicle nor induration of epididymis.

Case 242. Perfect result; January 1899, letter, 7 months.

Surgical No. 7762. W. N., æt. 32 years; laborer. Large, left inguinal hernia; reducible, complete, acquired, indirect, of 6 years' duration, of slow formation. Complete 1 year. Truss worn 1 year, not successful. Conjoined tendon obliterated. (Group B.) Operation 2-6-'98, Bloodgood; ether. Transplantation of rectus. Veins not excised. Wound closed, silver wire, 1 above, 4½ below cord. Catgut in aponeurosis. Gloves worn. Internal oblique wide and thick, divided. Conjoined tendon obliterated. Sac contained omentum very adherent at neck, ligated and excised with sac. Healing per primam, no swelling of testicle. No swelling of testicle or epididymis.

Case 243. Perfect result; December 10, 1898, letter, 6 months.

Surgical No. 7790. L. E., æt. 20 years; farmer. Small, right inguinal hernia; reducible, incomplete, congenital (sac complete), of 8 years' duration. Truss worn for short time at first (8 months), discarded afterwards. Operation 16-6-'98, Bloodgood; ether. Veins not excised. Wound closed, silver wire, 1 above, 4 below cord. Catgut in aponeurosis. Gloves worn. Internal oblique muscle wide and strong, divided. Conjoined tendon wide and firm. Approximation of divided internal oblique above and below cord with catgut (new method). Healing per primam. Absolutely no swelling of testicle nor induration of epididymis.

Case 244. Perfect result; June 1899, examination, 1 year.

Surgical No. 7793. J. F. C., æt. 41 years; boilermaker. Small, right inguinal hernia; reducible, incomplete, acquired, indirect, 2 years' duration, following heavy lifting. Truss worn a few months. No history of strangulation. Operation 28-6-'98, Young; ether. Internal oblique muscle not divided. Veins not excised. Closed, silver wire, 1 above, 3 below. Internal oblique muscle strong. Conjoined tendon wide and firm. Sac small, empty, not adherent. Healing per primam. Absolutely no swelling of testicle nor induration of epididymis.

Case 245. Perfect result; January 1899, examination, 6 months.

Surgical No. 7811. G. G., aet. 18 years; confectioner. Medium, right inguinal hernia; reducible, complete, acquired, indirect, of 3 years' duration, following strain, complete in 1 year. Truss worn. Operation 23-6-'98, Bloodgood; ether. Veins not excised. Third case of extensive plastic on internal oblique and suture to Poupart's and itself above and below cord with catgut. Wound closed, silver wire, 1 above, 3 below cord. Catgut in aponeurosis of external oblique. Conjoined tendon wide and firm. Sac contained omentum, not adherent. Gloves worn. Slight bronchitis followed operation; present before operation, increased afterwards for a few days. Temperature 102°-103°. Well on discharge. January 1899, six months, examined, wound solid, testicle normal.

Case 246. Perfect result; January 1899, examination, 6 months.

Surgical No. 7869. G. H., aet. 20 years; confectioner. Very large, right inguinal hernia; reducible with great difficulty, complete, acquired, indirect, of 7 years' duration, following jumping. Pain, hernia noticed in  $\frac{1}{2}$  hour. Irreducible 9 months. Truss worn 2 years. Operation 8-7-'98, Penrose; ether. Veins not excised. Internal oblique muscle strong, divided. Wound closed, silver wire, 1 above, 4 below cord. Catgut in divided internal oblique muscle and aponeurosis of external oblique. Gloves worn. Sac contained large mass of omentum, not adherent, reduced. Conjoined tendon wide and firm. Healing per primam. Slight bronchitis. Some swelling of testicle and induration of veins. January 1899, examination, six months, wound solid, testicle normal.

Case 247. Perfect result; January 1899, examination, 6 months.

Surgical No. 7904. P. S., aet. 40-50 years. Medium, left inguinal hernia; strangulated, acquired, complete, indirect, of 20 years' duration, following heavy lifting. Strangulated 36 hours. Operation 15-6-'98, Young; ether. Veins not excised. Wound closed, silver, 1 above,  $4\frac{1}{2}$  below cord. Catgut aponeurosis of external oblique. Sac contained bloody fluid and congested intestine. Conjoined tendon good. Internal oblique muscle strong, divided. Healing p. p. No swelling of testicle.

Case 248. Perfect result; January 1899, examination, 6 months.

Surgical No. 7913. C. L., aet. 16 years; schoolboy. Small, right inguinal hernia; reducible, incomplete, indirect, acquired, of 1 month's duration, no cause known, never strangulated. Operation 25-7-'98, Young; ether. Veins not excised. Wound closed, silver wire, 1 above and 4 below cord. Operator wore gloves. Conjoined tendon wide and firm. Internal oblique muscle divided, fair; sac empty; healing p. p.; no swelling of the testicle.

Case 249. Perfect result; January 1899, examination, 6 months.

Surgical No. 7924. D. H. J., aet. 36 years; clerk. Small, left inguinal hernia; reducible, indirect, complete, acquired, 7 years' duration. No cause

known. Never strangulated. Wears truss. Operation 26-7-'98, Young; ether. Veins not excised. Wound closed, silver wire, 1 above and 4 below cord. Sac contained adherent omentum, reduced. Conjoined tendon wide and firm. Internal oblique muscle good, divided. Gloves worn. Healing p. p. Gap  $\frac{3}{4}$ -in. upper end of skin. Slight swelling of testicle. No change in epididymis.

Case 250. Perfect result; January 1899, examination, 6 months.

Surgical No. 7931. G. H. J., aet. 18 years; baker. Large, left inguinal hernia; indirect, complete, reducible, acquired, 4 years' standing, following heavy lifting. Operation 27-7-'98, Young; ether. Veins not excised. Internal oblique muscle divided. Wound closed, 1 above and 4 below cord. Veins slightly varicosed, muscle good, conjoined tendon firm. Gloves worn. Healing p. p. No complications.

Case 251. Perfect result; March 1899 (letter), physician, 8 months.

Surgical No. 7941. J. G., aet. 16 years; schoolboy. Small, left inguinal hernia; reducible, incomplete, acquired, indirect, noticed 2 months, no pain, no traumatism after wrestling and heavy lifting, no truss, never strangulated. Operation 28-7-'98, Finney; ether. Veins not excised. Wound closed, silver wire, one above and four below cord. Divided internal oblique muscle first approximated with catgut. Silver wire subcutaneous closed. Gloves worn. Healing p. p. No swelling of the testicle.

Case 252. Perfect result; June 1899 (letter), 10 months.

Surgical No. 7950. D. B. P., aet. 39 years; mechanic. Large, right inguinal hernia; reducible, complete, acquired, indirect, of 29 years' duration, of rapid formation, following injury. Operation 5-8-'95, Young; ether. Veins not excised. Internal oblique muscle good, divided and transplanted. Conjoined tendon wide and firm. Wound closed with silver wire, one above and four below cord. Sac contained omentum, not adherent, reduced. The dissection of the sac and the veins of the testicle was very difficult, and the veins were injured in two or three places. Immediately following the operation the right side of the scrotum became very much distended and the skin ecchymotic, evidently a haematoma. On the 10th day wound was examined and found to be distended with blood, which was clotted. The skin incision was opened under ether narcosis, the blood-clots were removed, the wound irrigated with bichloride 1-1000 salt solution, the skin incision again closed in the usual way. There was no evidence of infection of the wound and it healed per primam. Convalescence otherwise uneventful. In cases where a haematoma forms in the scrotum directly after an operation, it would be better to examine the wound at once, and if distended with blood, to remove the skin wire, open the skin incision, and thoroughly evacuate the blood, because the earlier this is done the less the danger of infection. However, in this case the result has been perfectly satisfactory.

Case 253. Perfect result; April 1899 (letter), 8 months.

Surgical No. 7960. A. W. W., aet. 21 years; farmer. Small, left inguinal hernia; complete, indirect, acquired, 1 week's duration. Muscles good, strong. Conjoined tendon strong and wide. Operation 1-8-'98, Finney; ether. Cord transplanted. Veins not excised. Internal oblique not divided. Wound closed, 1 above and 4 wire mattress sutures below cord. Skin closed, subcutaneous suture. Healing p. p. No complications.

Case 254-255. Perfect result; March 1899 (letter), physician, 7 months.

Surgical No. 7966. I. S., aet. 30 years; clerk. Small, right inguinal hernia; reducible, incomplete, acquired, indirect, of 1 year's duration. Has worn truss. On the left side there is a distinct bulging at the external ring and the conjoined tendon, if present, is weak and relaxed. Operation 6-8-'98, Young; ether. Right side: Veins not excised, internal oblique muscle divided, conjoined tendon wide but not strong, muscle also thin, wound closed with silver wire, 1 above and 4 below the cord, sac empty. Left side: Veins not excised, rectus muscle transplanted, internal oblique muscle not divided, wound closed with silver wire, 2 above and 3 below cord. On this side the conjoined tendon is obliterated and there is a distinct bulging of the peritoneum between the outer border of the rectus muscle and the internal oblique, muscle. Both wounds healed per primam. No swelling of either testicles or veins. Convalescence uneventful.

Case 256. Perfect result; March 1899 (letter), 7 months.

Surgical No. 7969. G. K., aet. 58 years; laborer. Speaks Greek only. Small, left inguinal hernia; reducible, complete, acquired, indirect, right testicle atrophied. Operation 6-8-'98, Huger; ether. Veins not excised. Internal oblique muscle thick, divided and transplanted. Conjoined tendon wide and firm. Wound closed, silver wire, 1 above, 5 below cord. Gloves worn. Healing p. p. Convalescence uneventful.

Case 257. Perfect result; March 1899, examination, 7 months.

Surgical No. 7979. L. B., aet. 65 years. Very large, left inguinal hernia; reducible, complete, acquired, indirect, of 9 years' duration, following heavy lifting. Descended into the scrotum at the end of 6 months. The hernia extends beyond the middle third of the thigh, 23 cm. below the level of the symphysis pubis. When the rupture is reduced the index finger finds the conjoined tendon completely obliterated. Operation 9-8-'98, Young; chloroform. Chloroform was used on account of marked emphysema of the lungs. The anæsthetic was well taken. Veins not excised. Internal oblique muscle divided and transplanted. Rectus muscle transplanted. Wound closed with silver wire, 1 above and 5 below the cord. The conjoined tendon was completely obliterated. The opening of the abdominal cavity extended from the outer border of the rectus to the

internal oblique muscle. Gloves worn. Healing per primam. No swelling of testicle. Convalescence uneventful.

Case 258. Perfect result; examination, June 1899, 10 months.

Surgical No. 7995. J. P., æt. 30 years; candymaker. Large, right inguinal hernia; reducible, complete, acquired, indirect. Operation 12-8-'98. Young; ether. Internal oblique muscle strong, divided and transplanted. Conjoined tendon wide and firm. Wound closed with silver wire, 1 above and 5 below cord. Veins not excised. The sac contained the cæcum and appendix and the peritoneum of the sac was continuous with the peritoneum of the cæcum. The appendix was removed. Gloves worn. Healing per primam. No swelling of testicles or veins. Convalescence uneventful.

Case 259. Perfect result; April 1899, letter, 6 months.

Surgical No. 8078. C. E. B., æt. 30; jeweler. Large, left inguinal hernia; reducible, complete, acquired, indirect, of 17 years' duration, following heavy lifting. The hernia descended into the scrotum at the end of 2 years. The last few years the truss has not retained the hernia and has given a good deal of discomfort. During the past year the hernia has been irreducible at intervals—never longer than 48 hours. There have been no symptoms of strangulation. Examination: The large mass distends into and completely fills the scrotum. The mass is situated between the testicle and the middle septum of the scrotum. The testicle is pushed outwards, forming a definite protuberance. The mass is dull on percussion, doughy in consistency, and in it one feels small masses. Operation 8-9-'98, Cushing; ether. Veins not excised, cord transplanted *in toto*, internal oblique muscle divided and transplanted, rectus muscle transplanted. Wound closed with silver wire, 2 sutures above and 5 below the cord. Operator wore gloves. Sac contained a large mass of omentum, which was excised. Omentum was not adherent, but very indurated. The rectus muscle was transplanted, because conjoined tendon was relaxed. The lower four sutures included the rectus muscle. A slight swelling of the testicle and veins followed the operation. The wound healed per primam. At the end of 3 weeks a small haematoma 1 x 1 cm. was noticed, situated in the cord, above 2 cm. from the epididymis.

Case 260. Perfect result; March 1899, examination, 7 months.

Surgical No. 8092. W. W., æt. 25; laborer. Small, right inguinal hernia; reducible, complete, acquired, indirect, of 7 weeks' duration, no apparent cause, never strangulated, truss not worn. Conjoined tendon wide and firm, no varicocele. Operation 12-9-'98, Cushing; ether. Veins not excised, cord transplanted *in toto*, internal oblique muscle divided and transplanted. Because the internal oblique was weak and situated high the rectus muscle was transplanted. Wound closed with silver wire, 1 above and 3 below the cord. The lower 3 sutures included the rectus muscle. Operator wore gloves. Following operation there was some swelling of the veins of the right cord, which disappeared in a few days. Wound healed per primam, except the lower third of the skin incision, which had not been perfectly approximated. Over this portion there was a narrow line of granulated tissue, which rapidly became covered with epithelium.

Case 261. Perfect result; last examination June, 1899, 9 months.

Surgical No. 8124. A. Y., aet. 20; laborer. Small, right inguinal hernia; reducible, complete, congenital. Hernia noticed since the first year of life. Descended into scrotum 2 years ago after jumping. Truss worn for 2 years. Operation 17-9-98, Cushing; ether. Veins not excised. Cord transplanted *in toto* in the divided and transplanted internal oblique muscle. Wound closed with silver wire, 1 above and 4 below the cord. Conjoined tendon wide and firm. The sac was of the congenital variety, from 5 to 8 mm. in diameter and very adherent to the vessels; 2 cm. from the testicle the lumen of the sac was almost completely closed by a septum of tissue. Operator wore gloves. Very slight swelling of testicle and vessels followed operation, which disappeared in a few days. Healing absolutely per primam. December 6, 1898, examination (2 months since operation): wound solid, position of the transplanted cord not to be made out, external ring admits the little finger, testicle normal, no varicocele, perfect result.

Case 262. Perfect result; June 1899, examination, 8 months.

Surgical No. 8174. Aet. 50. Medium, right inguinal hernia, following a strain. The hernia descended into the scrotum 6 months ago. Truss worn, which has given a great deal of discomfort. Operation 1-10-98, Cushing; ether. Veins not excised. Cord transplanted *in toto* in the divided and transplanted internal oblique muscle. Wound closed with silver wire, 1 above and 4 below the cord. Conjoined tendon wide and firm. Operator wore gloves. Very slight swelling of the testicle and veins followed operation, which disappeared in a few days. On the 18th day a small haematoma, which had appeared beneath the skin, was evacuated, and the small opening healed in a few days: otherwise the wound healed per primam.

Case 263. Perfect result; June 1899, examination, 8 months.

Surgical No. 8190. B. F., aet. 15; schoolboy. Medium, right inguinal hernia; reducible, complete, acquired, indirect, hernia of 4 years' duration, no cause. The hernia descended into the scrotum at the end of one month. Operation 14-10-98, Finney; ether. Veins not excised. Cord transplanted *in toto*. Internal oblique muscle divided and transplanted. Wound closed with silver wire, 1 above and 3 below the cord. Conjoined tendon was wide and firm. Sac contained a small piece of omentum, adherent, which was excised. Diameter of sac was about 8 mm. and was very adherent to cord. Operator, in suturing the peritoneum above the sac, drew the bladder into view. Operator wore gloves. Wound healed absolutely per primam. No swelling of testicle, epididymis or veins.

Case 264. Perfect result; June 1899, examination, 8 months.

Surgical No. 8214. C. S., aet. 17; painter. Medium, left inguinal hernia; reducible, incomplete, acquired, indirect. Hernia of one month's duration, following 2 days after a strain. Truss not worn. Conjoined tendon wide

and firm; no varicocele. Operation 13-10-'98. Cushing; ether. Veins not excised. Cord transplanted *in toto*. Internal oblique muscle very thin, and for this reason it was not divided, but the rectus muscle was transplanted. Wound closed with silver wire, 1' above and 3 below the cord—the lower 3 sutures including the rectus muscle. Operator wore gloves. Wound healed per primam. No swelling in the testicle, epididymis or cord followed operation.

Case 265. Perfect result; June 1899, examination, 8 months.

Surgical No. 8222. W. H. S., aet. 25; clerk. Medium, left inguinal hernia; reducible, complete, congenital; also a large varicocele on the right side. Typhoid fever 2 years ago. One month after convalescence, after lifting a heavy barrel of apples, the patient felt a slight pain and noticed a swelling in left groin. He wore a bandage for a few weeks. Four weeks ago, without apparent cause, he noticed the swelling for a second time. When the hernia is reduced the left external ring is larger than the right. Both conjoined tendons are wide and firm. Operation 12-10-'98, Cushing; ether. Veins excised. Cord transplanted in divided and transplanted internal oblique muscle. Wound closed with silver wire, 1 above and 3 below the cord. Conjoined tendon wide and firm. Operator wore gloves. Wound healed per primam. Very slight swelling of the testicle followed operation. The veins below the ligature became thrombosed, and when the patient left the hospital, three weeks after operation, there was a narrow indurated cord extending between the external ring and epididymis.

Case 266. Perfect result; June 1899, examination, 8 months.

Surgical No. 8231. L. A. A., aet. 24; farmer. Large, right inguinal hernia; reducible, complete, acquired, indirect. The hernia is of 2 years' duration, and of slow formation, with no apparent cause. At the same time with the appearance of the hernia a hydrocele formed, which has been aspirated twice. Examination: A large tumor fills the right side of the scrotum, extending into the external ring, and one can feel an indurated epididymis and a thickened cord. The right testicle appears to be the same size as the left. On reducing the hernia the external ring admits the two fingers, and the conjoined tendon is narrow and very relaxed. Operation 15-10-'98, Cushing; ether. Veins not excised. Cord transplanted *in toto* into the divided and transplanted internal oblique muscle. The rectus muscle was transplanted because of the weakness of the conjoined tendon. Wound closed with silver wire, 1 above and 4 below the transplanted cord. Operator wore gloves. It was found that there were two sacs. The lower one formed by the tunica vaginalis contained fluid, about 100 cc. The amount of fluid was not sufficient to make the sac tense, so that before operation this fluid had easily been pushed up into the abdominal cavity through the external ring, and apparently reduced the hernia. Above and adherent to this hydrocele sac was the sac of the acquired hernia, which was also large and adherent. Both sacs were excised. A portion of the hydrocele sac was sutured over the testicle. The rectus muscle was thin and poorly developed. Wound healed per primam. There was some slight swelling of testicle and

scrotum and some induration of epididymis and cord. The induration was probably due to the thrombosis of the veins or the thickening of the hydrocele sac. It had not disappeared 3 weeks after operation.

Case 267. Perfect result; June 1899, examination, 8 months.

Surgical No. 8295. O. S., aet. 25; coachman. Small, right inguinal hernia; reducible, complete, acquired, indirect, of 14 years' duration, following jumping. A truss kept the hernia in place for 3 months, since which time it has been of little value and has given a good deal of discomfort. Operation 4-11-'98, Finney; ether. Veins large, not excised. Cord transplanted *in toto* into the divided and transplanted internal oblique muscle. Conjoined tendon wide and firm. Wound closed with silver wire, 2 above and 3 below cord. Operator wore gloves. Sac contained omentum which was adherent in all directions. The omentum was ligated and excised with the sac. Healing per primam. No swelling of testicle nor induration of epididymis followed operation.

Case 268. Perfect result; June 1899, examination, 8 months.

Surgical No. 8325. G. B., aet. 20; student. Small, right inguinal hernia; complete, reducible, acquired, indirect, of 5 years' duration, without apparent cause. Hernia descended into the scrotum 8 months ago. Truss worn. Operation 16-11-'98, Cushing; ether. Veins not excised. Cord transplanted *in toto* into the divided and transplanted internal oblique muscle. Conjoined tendon wide and firm. Wound closed with silver wire, 1 above and 3 below the cord. Operator wore gloves. Sac contained omentum, not adherent, which was reduced. Healing absolutely per primam. No swelling of testicle nor induration of epididymis followed operation.

#### GROUP I (A). THE VEINS ONLY TRANSPLANTED; THE REMAINDER OF THE CORD LEFT UNDISTURBED IN THE INGUINAL CANAL.

2 CASES. FIRST OPERATION OCTOBER 25, 1898.

Case 1. Perfect result; examination January 20, 1899, 3 months.

Surgical No. 8245. G. M. S., aet. 27; farmer. Medium, right inguinal hernia; reducible with difficulty, complete, acquired, indirect, of 15 years' duration. Complete 5 years, irreducible 3½ months, never strangulated. Truss worn. Examination before operation: Extending from the right external ring down to within 2 cm. of the top of the testicle there is a small sausage-shaped tumor, is about 5 cm. in length, and about 1.5 to 2 cm. in diameter. The tumor is not tense nor is it doughy in consistency. It is not completely reducible. It is somewhat like a sac half filled with fluid, but on careful manipulation it is found that part of the mass can be reduced, and when the patient coughs two or three times the soft mass returns and completely fills the sac, making it tense. After this occurs further coughing gives no impulse. It is dull on percussion. Operation 25-10-'98, Bloodgood; ether. A typical Halsted operation, except the veins only were transplanted, the vas deferens and its immediate vessels were

left undisturbed in the inguinal canal. The internal oblique muscle was divided and transplanted, and held in place with catgut; the wound closed with one silver wire above and four below the transplanted veins, catgut in the aponeurosis of the external oblique. Conjoined tendon was wide and firm. The sac was long and narrow and contained omentum. It was slightly adherent at the neck and at the fundus and at the ring, of an hour-glass constriction situated in the centre of the sac. In the lower portion of the sac there was a little clear fluid. In this operation the peritoneum, after the division of the internal oblique muscle, was opened above the neck of the sac, allowing a better study of sac and its anatomy. The omentum was freed and reduced. The operator in this case, instead of transplanting the entire cord or reducing the size of the cord by excising the veins, divided cord into two portions, transplanting the bunch of veins, which are usually excised, and leaving the vas deferens and small number of accompanying vessels undisturbed in the inguinal canal. Gloves worn. Healing per primam. Convalescence uneventful. No swelling of testicle followed operation.

Case 2. Perfect result; April 1899, examination, five and one-half months. Operation with cocaine anaesthesia.

Surgical No. 8278. J. M. C., æt. 37; porter. Small, right inguinal hernia; reducible, incomplete, acquired, indirect, of 17 weeks' duration. No history of traumatism. Truss not worn. Operation 29-10-'98, Bloodgood; cocaine. Typical Halsted operation, except the veins only were transplanted. Internal oblique muscle divided, transplanted and held in place by catgut. Wound closed with silver wire, one suture above and four below the transplanted veins. The vas deferens and immediate vessels not disturbed. Catgut in aponeurosis of external oblique. Gloves worn. Conjoined tendon wide and firm. A mass of properitoneal fat, about 4 x 3 cm. (twice the size of the sac), was situated in the infundibuliform fascia to the lower and medial side of sac and vas deferens. Its pedicel accompanied the vas deferens and its vessels towards the pelvis, the latter being situated between the sac and the fat. The pedicel was ligated with 4 sutures of heavy black silk and a mass of fat excised. Without doubt this mass and properitoneal fat formed most of the hernial protrusion. During the operation the vas deferens and its immediate vessels were not stripped from their bed in the inguinal canal. The points of interest in the cocaine anaesthesia were: The skin incision was inadvertently made a little lower than usual and a subcutaneous nerve, the ilio-hypogastric, accompanying the superficial external pubic artery was divided. The pain was sharp and severe and caused the patient to jump. Before dividing the coverings of the sac the ilio-inguinal nerve was injected with cocaine, following which the division of the sac gave no pain. In the lower border of the internal oblique muscle division of the hypogastric branch of the ilio-hypogastric gave pain, otherwise the division of the muscle was not very painful. Operation was as satisfactory as under ether anaesthesia. The wound healed per primam. No swelling of the testicle or the veins followed operation. January 13th, 1899, 2½ months, examination: wound solid, position of the transplanted veins not to be made out. The external ring just admits the little finger, directly behind the pillar one feels the strong conjoined tendon. Testicle, epididymis and cord normal.

## GROUP II. 25 CASES IN WHICH THE CORD WAS NOT TRANSPLANTED.

Case 1. Complete recurrence; last examination September 1897, 7 years 4 months. Lower third of wound suppurated; conjoined tendon obliterated.

Surgical No. 448. G. G., aet. 38; laborer. Large, left inguinal hernia; irreducible, complete, acquired, indirect, of 11 years' duration, following heavy lifting. Has always worn a truss until 4 weeks ago, when during a fit of coughing the hernia came down past the truss. Since which it has been irreducible. No symptoms of strangulation. Operation 2-5-'90, Halsted. Sac very large, walls thick. The ring admits 4 fingers. Sac contained omentum, which was not adherent and which was reduced. The intestines were adherent to the neck of the sac. The muscle was split, but the cord was not transplanted. Wound closed with silk and irrigated. The wound healed p. p., but on the 12th day a stitch abscess formed in the lower third of the wound and was opened. The stitch sinus closed in 4 months. One month later an impulse and bulging were noticed in the scar over the area of the stitch abscess. Two years later there was a complete recurrence. April 1894, 4 years, examination: the recurrence is in the lower third of the wound; the ring, which admits 2 fingers, is just above the spine of the pubis; the recurrence has taken place along the cord and in the area of the stitch abscess. September 1897, examination, 7 years 4 months: the recurrence has not increased in size since the last examination, the hernia descends into the scrotum down to the testicle; it is reducible and held in place by a truss. The opening is just above the pubes and is about 3 x 4 cm. in diameter; the fingers enter directly into the abdominal cavity; the conjoined tendon seems obliterated. The scar is 15 cm. long and extends from the anterior iliac spine down into the scrotum. Over the area of recurrence the scar is 3 cm. wide; the upper portion of the wound is solid. Both testicles are normal. One year ago a hernia appeared on the right. September 1898, letter, no change.

Case 2. Perfect result; last examination March 1895, 3 years 3 months; last report (letter) September 1897, 6 years 9 months.

Surgical No. 737. A. E., aet. 5; boy. Small, left inguinal hernia. A recurrence 4 months after operation by McBurney's method (see Group VI, Case 4, Surgical No. 549). Operation 5-12-'90, Halsted. There was a distinct sac, which was very adherent to the surrounding tissues. It was excised and closed. The muscle was split in order to close the sac as high as possible. The cord was so adherent that it was not transplanted. Wound closed with silk. Healing p. p. Highest temperature 100°. March 1894, 3 years and 3 months, examination, wound solid, no atrophy of testicle, perfect result. September 1897, letter, well.

Case 3. Perfect result; last report (letter) January 1893, 1 year.

Surgical No. 1397. H. R., aet. 20. Small, right inguinal hernia; reducible, of 7 months' duration. Recurrence after operation in Chicago 6 months

ago. The wound suppurated and the hernia returned in a few days after the patient got out of bed at the end of 5 weeks. It gives him much pain and discomfort. Operation 8-1-92, Halsted. Sac small, very adherent. Closed as high as possible. Cord not transplanted because of adhesions. Muscle split. Wound closed with silk. Healing p. p. Highest temperature 101°. January 1893, 1 year, patient writes that he is perfectly well. There is no recurrence of the hernia. The patient has not been heard from since.

Case 4. Complete recurrence; last examination May 1894, 2 years. Conjoined tendon obliterated. Wound entirely opened on 9th day for haemorrhage.

Surgical No. 1632. T. M., aet. 33; colored, laborer. Very large, right inguinal hernia; strangulated, complete, acquired, indirect, of 5 hours' duration, following immediately after an injury in the groin. Operation 24-5-92, Baltzell. Sac large, wall very thin. Contents: 40 cc. of a straw-colored fluid, a large mass of omentum, a large portion of the small intestine, cæcum and appendix. Beneath the peritoneum of the appendix there had been some haemorrhage. For this reason it was excised. The omentum and remainder of the intestine were reduced. The peritoneum was closed with silk and the muscle and fascia with silk. The cord was not transplanted. The wound was opened on the 9th day for distention with blood. The deep sutures were not removed. It healed by granulation in 5 weeks. The hernia returned in 5 days after leaving the hospital. The patient states that while walking about the hernia suddenly appeared in the groin and descended into the scrotum (?). On examination, 2 years later, there is a large, reducible hernia extending into the scrotum. The ring is 3 cm. in diameter. Patient suffers very little discomfort from the rupture. Refuses to be operated on again.

Case 5. Perfect result; last report (letter) March 1897, 4 years.

Surgical No. 2035. L. N., aet. 2; colored boy. Large, right inguinal hernia; strangulated, complete, congenital. Hernia present since 1 month of age. Has always worn a truss. Strangulation 3 days. Operation 29-1-93, Baltzell. Sac very large. Contained cæcum and appendix, which were reduced. Wound closed with silk. The cord was not transplanted. Healing p. p. Highest temperature 102°. Slight diarrhea followed operation, lasting three days. October 1894, 10 months, mother writes that the child is perfectly well. March 1897, letter, well, 4 years.

Case 6. Perfect result; last examination January 1899, 3 years and 11 months since operation. Superficial and partial suppuration of the skin. Secondary stitch abscess from one silver wire suture.

Surgical No. 3999. E. W., aet. 34; laborer. Large, right inguinal hernia; strangulated, complete, acquired, indirect, of 6 days' duration, following immediately after a strain while lifting a heavy anchor. Patient was attacked with vomiting and pain in the abdomen at once, which has continued at intervals ever since. The bulging in the groin was not noticed

until to-day. Operation 17-3-'95, Halsted. Sac large, wall thick. Hernia appears to have been of longer duration than history wound indicate. Seat of strangulation outside of the sac at the neck. Contents of sac: clear fluid, omentum and intestine, which were returned. Veins small, not excised. Cord not transplanted, because the patient was in no condition for a prolonged operation. The muscle was split to give more room for the reduction of the intestine. Wound closed with silver wire. The cord prevented a complete closure of the external ring. Irrigation with 1 to 1000 bichloride. Small bismuth gauze drain at lower angle, because of oozing. The gauze was removed in 24 hours. On the 10th day the middle third of the wound was opened for a superficial stitch abscess. Patient discharged in 6 weeks, wound healed. No induration of epididymis followed operation. Highest temperature 102.5°. June 1895, 2½ months, examination, wound solid, testicle and epididymis normal, perfect result. July 1895, a very small abscess and sinus found in the lower angle of the wound and one silver wire discharged in three weeks; this gave very little discomfort and did not prevent patient from working. October 1897, examination, 2 years 7 months: wound solid, the upper four silver sutures are palpable but give no discomfort, the external ring admits the little finger (6 mm.), there is no impulse, the testicle and epididymis are normal, there is no varicocele, perfect result. August 1898, examination, perfect result.

Case 7. Perfect result; last examination December 1897, 2 years 2 months; September 1898, dead. Small direct hernia; conjoined tendon wide and firm; sac not opened because the colon appeared adherent; cord not transplanted because of the small size of the hernia.

Surgical No. 4663. J. E. S., aet. 45; colored, coachman. Small, left inguinal hernia; reducible, incomplete, acquired, direct. Double hydrocele of 1½ years' duration, of rapid formation, following a strain. Hydroceles of 5 months' duration. Truss worn the last 2 months and is of no value. Operation 10-10-'95, Halsted. Sac not opened, because it was intimately adherent to a loop of large intestine. Muscle split, cord not transplanted. Wound closed with silver wire. Irrigated with 1 to 1000 bichloride. The tissues, which were approximated over the reduced hernia, were very thin. A recurrence may be expected. Fluid in both hydroceles aspirated. October 1896, both hydroceles have recurred, hernia wound solid. Operation on right inguinal hernia and hydrocele (Group I, Case 158). May 1897, sac of left hydrocele excised, incision in scrotum, cocaine, healing p. p. August 1897, 1 year 10 months, examination: perfect result, external ring closed, testicles normal. December 1897, 2 years 2 months, examination: perfect result; since last examination there is a small amount of fluid in the tunica vaginalis, which does not give any discomfort. September 1898, letter, dead, no recurrence of hernia.

Case 8. Perfect result; last report (letter) November 1898, 2 years 8 months. Atrophy of testicle; veins excised.

Surgical No. 5287. (For history see Group III, Case 11.) Small, double inguinal hernia; reducible. On the left side before operation there had

been a slight impulse, and at the operation a small protrusion of peritoneum was found to extend along the cord for about 1 cm. In this case the veins were excised, and the pillars of the external ring only closed with buried sutures of silver wire, the cord being brought out above the sutures through the aponeurosis of the external oblique muscle. Wound healed p. p. Following operation there was a good deal of swelling of the testicle and induration of the epididymis. The stump of the ligated veins and the epididymis were agglutinated together in one mass, in which the vas deferens could not be differentiated. 10 weeks after the operation there seemed to be beginning atrophy of the testicle. September 1897, 1 year 5 months, letter, well, atrophy of testicle. November 1898, 2 years 8 months, examined, well, atrophy of the testicle.

Case 9. Perfect result; last report (by physician) September 1898, 2 years. Atrophy of testicle; veins not excised.

Surgical No. 5983. R. L. N., aet. 66; farmer. Very large, right inguinal hernia; reducible, complete, acquired, indirect, of 15 years' duration. Also a large, left inguinal hernia; reducible, complete, of 5 years' duration. Patient's general health excellent. Operation 11-11-'96, Halsted. Veins not excised. Cord not transplanted. Wound closed with 7 sutures of silver wire. The operation in this case was a very difficult one, and subcutaneous fat was very thick. The sac was adherent to all the surrounding tissues and to the bladder. The conjoined tendon was obliterated. The opening into the peritoneal cavity extended well down to the pubic bone. The sac was dissected from the cord, testicle, bladder and surrounding tissues with a good deal of difficulty; the opening into the peritoneal cavity was closed with silk and the remainder of the sac was excised and the wound closed with silver wire. No drainage was used, although, on account of the absence of the conjoined tendon and the dissection of the sac from the bladder, a small dead space was left near the bladder, but it was considered best to trust to a blood-clot rather than a drain. For 3 days the patient suffered a great deal from intestinal colic and distention, but was relieved by the use of the Paquelin cautery and high enemata. The highest temperature was 102.4°, which took place on the 8th day. Patient suffered no pain or inconvenience from the wound. On the 12th day, associated with no rise of temperature or discomfort, it was found that the blood-clot (which had filled the supra-vesicular fossa described in the operation) had broken down and was discharging its contents through a small opening in the lower angle of the skin incision just above the pubes. This opening was enlarged to 2 cm. The blood-clot cavity measured about 2 x 3 cm., and healed perfectly from the bottom in about 7 days. Otherwise, the healing of the wound was absolutely p. p. No silver wires discharged. Directly after the operation there was very marked swelling of the testicle with oedema of the scrotum and some ecchymosis. After this temporary swelling and oedema went down, it was found that the testicle, epididymis and cord were matted together in one mass, pyriform in shape. This epididymitis was associated with some tenderness. Patient discharged from the hospital in 4 weeks in splendid condition. The swelling of the testicle and induration of the epididymis had but slightly changed. February 1897, letter,

patient writes that he is perfectly well, but that the testicle is still slightly swollen. August 1897, letter, 8 months, wound solid, atrophy of the testicle, general health excellent. To return in October for operation on the left side. September 1898, 2 years, letter from physician, wound solid, perfect result.

Note.—This patient represents one of the most difficult operations for hernia, and the patient is the oldest in this list of cases.

Case 10. Perfect result; last report (letter) October 1897, 9 months.

Surgical No. 6171. J. W. H., aet. 21; clerk. Small, left inguinal hernia; reducible, incomplete, acquired, indirect, of 15 months' duration, following heavy lifting. A bulging in the groin and varicocele were noticed at the same time. Operation 11-1-'97, Bloodgood. Veins large, excised. No hernial sac could be found, although before operation there was a distinct impulse and bulging. The cord was not transplanted nor the internal oblique muscle divided, but the aponeuroses of the external oblique, internal oblique muscle and conjoined tendon were sutured to Poupart's ligament with silver wire. Healing p. p. Highest temperature 100.2°. Very slight swelling of the testicle and induration of the epididymis followed the operation, lasting about two weeks. October 1897, letter, well, 9 months.

Case 11. Perfect result; March 1898, letter.

Surgical No. 6197. J. McP., aet. 54; blacksmith (for note on hernia and operation see Group I, Case 168). March 1898, letter, perfect result.

Case 12. Perfect result; last examination August 1897, 8 months. Cord not transplanted to give method a trial; veins excised.

Surgical No. 6202. B. H., aet. 24; waiter. Medium, right inguinal hernia; reducible, incomplete, acquired, indirect, of 2 years' duration, of rapid formation, following a strain. Has worn a truss. Operation 21-1-'97, Halsted. Veins large, excised. Wound closed with 5 sutures of silver wire without transplantation of the cord. In this case, although the veins were excised, the vas deferens and its vascular constituents were not disturbed in their position in the inguinal canal. The sac was of medium size and its opening was closed with silk. The divided internal oblique muscle was wide and thick and was included by 4 of the 5 sutures. Healing absolutely p. p. Following immediately after the operation there was very slight swelling of the testicle and in a few days some induration of the epididymis, associated with a little tenderness. Highest temperature 102°, associated with slight bronchitis. The cord in this case was not transplanted in order to test this method for operations on small and not difficult herniae. August 30, 1897, 8 months, examination, wound solid, external ring closed snugly about cord, no impulse, testicle and epididymis normal, perfect result.

Case 13. Perfect result; last examination October 1898, 1 year 8 months since operation. Hydrocele followed operation. Veins excised.

Surgical No. 6309. J. E. B., aet. 29; commercial agent. Large, left inguinal hernia; reducible, complete, acquired, indirect, of 10 years' duration, following heavy lifting. Has worn a truss for 5 years. Four years ago he tried the injection treatment: one injection once a week for 15 weeks, with no result. Operation 25-2-97. Halsted. Veins large, excised. Cord not transplanted. Wound closed with 5 sutures of silver wire. In this case the subcutaneous fat was very thick (the patient weighed 220 pounds). There was much new connective tissue between the subcutaneous fat and the aponeurosis of the external oblique muscle. After the division of the aponeurosis of the external oblique muscle and the coverings of the sac, a very interesting condition was found: The sac was composed of two parts and both contained omentum. The upper part, which opened directly into the peritoneal cavity, was invaginated into the lower or second part of the sac. This second sac communicated with the first sac by an opening 3 mm. in diameter, which was situated at the apex of the invaginated portion of the first sac, and it was through this small opening that the omental contents of each sac was continuous. The sac and its omental contents were excised and the opening into the peritoneal cavity closed with black silk. In this case the veins accompanying the cord were excised and ligated and the cord itself, during the dissection of the sac, was torn from its bed in the inguinal canal and subjected to a good deal of manipulation, but it was not transplanted. The internal oblique muscle was thick and was included in most of the sutures. The conjoined tendon was wide and firm. Healing p. p., except 2 cm. of the middle third of the skin incision, which was opened on the 6th day for inspection on account of continuous high temperature of 102°. There was no evidence whatever of infection of the wound, temperature being due to a large boil on the back. This small wound healed in a few days. Following the operation there was a good deal of swelling of the testicle and induration of the epididymis; much of the swelling of the testicle was due to the formation of a small hydrocele. Examination May 1897, 1½ months, wound solid, external ring closed, stump of the ligated veins was about 1½ cm. in diameter. The testicle was slightly enlarged, due to the small hydrocele, which prevents palpation of the epididymis. No evidence whatever of atrophy of the testicle, with the exception of the small hydrocele. Result is a perfect cure. August 1897, examination, 6 months, wound solid; two weeks ago a small abscess formed in the lower angle of the wound, due to a silk ligature on a skin vessel; there is present now a small sinus, hydrocele no larger, no atrophy of the testicle. September 1897, examination, 7 months, wound solid, sinus healed, wires not palpable, hydrocele no larger. March and October 1898, examination, well, hydrocele no larger.

Case 14. Perfect result; September 1898, letter, 10 months.

Surgical No. 7178. A. B. H., aet. 28 years; naval officer. Small, left inguinal hernia; reducible, complete, acquired, indirect, of 10 months' duration, following a strain, while slipping on an icy deck, of rapid forma-

tion. Truss worn. Operation 21-11-'97, Halsted; ether. Veins not excised. Cord not disturbed. Internal oblique divided and transplanted. Conjoined tendon wide and firm. Wound closed with silver wire. Gloves worn. Healing per primam. No swelling of testicle followed operation. Patient writes, September 1898, that the result is a perfect one.

Case 15. Partial recurrence in the lower angle of the wound 6 weeks after operation. Conjoined tendon obliterated; cocaine anaesthesia.

Surgical No. 7196. J. S., æt. 53 years; baker. Large, left inguinal hernia; complete, acquired, indirect. Symptoms of strangulation 48 hours. Hernia of 30 years' duration; has always worn a truss; 48 hours before admission, while doing heavy lifting, the rupture slipped by the truss and became irreducible. Three attempts at taxis failed. Condition on admission not good. Respiration 51, pulse 108°, temperature 99.8°. Operation 11 P. M., December 6, 1897, Cushing; *cocaine*. Veins not excised. Cord not transplanted. Internal oblique muscle divided and transplanted. Wound closed with silver wire. Gloves not worn. Sac contained omentum, one loop of one intestine and blood-stained fluid. Contents reduced. The suture of the wound was not very satisfactory. Healing per primam. No complications followed operation. Second operation (see Group VIII, Case 4): Testicle replaced in abdominal cavity. Wound closed, healing p. p. At the same time operation for hernia on the right side. (See Group I, Case 221.) Wound closed with silver wire. Healing p. p. Recurrence on left side due to the descent of the testicle in three months. Third operation (see Group IV, Case 26): Castration. Rectus muscle transplanted. Wound closed with silver wire. Healing per primam. January 1899, 7 months, examination, both wounds solid, right testicle normal, patient's health excellent, perfect result.

Case 16. Perfect result; examination August 1898, 8 months.

Surgical No. 7208. A. P. W., æt. 41 years; hotel clerk. Small, right inguinal hernia; reducible, complete, congenital, of 20 years' duration, following a strain. Truss worn. Very small, left inguinal hernia. Undescended testicle of 20 years' duration. Truss worn. Operation 15-12-'97, Halsted-Cushing; ether. Right side (Group II): Cord not transplanted. Veins not excised. Wound closed, silver wire. Internal oblique muscle weak, divided. Conjoined tendon very weak. Two portions to congenital sac. No gloves. Left (Group VII, Case 1): Replacement of undescended testicle. Wound closed, silver wire. Internal oblique weak, divided. Conjoined tendon obliterated. Transplantation of rectus. Sac not opened. Gloves worn. Healing per primam, both sides. No swelling of testicle nor induration of epididymis on right side.

Case 17. Perfect result; January 28, 1899, examination, 12 months.

Surgical No. 7296. C. F., æt. 19 years; plumber. Large, right inguinal hernia; reducible, complete, acquired, indirect, of 15 years' duration,

following traumatism. Truss worn. Operation 19-1-'98, Halsted; ether. Group II. Cord not transplanted. Veins not excised. Sac large, not adherent. Internal oblique muscle divided and transplanted. Wound closed with 5 sutures of silver wire. Healing p. p., except a small, superficial stitch abscess in lower angle of wound from ligature (17th day). Slight swelling and tenderness of testicle, epididymis and veins. No induration (Class III). Catheterization on 2d, 3d and 4th days. August 28, 1898, 8 months, examination, wound solid, external ring snugly closed about cord, testicle normal, perfect result.

Case 18. Perfect result; November 1898, examination, well, 4 months. *New method.* Cord not transplanted; rectus muscle transplanted.

Surgical No. 7814. L. F., aet. 48 years; insurance agent. Large, left inguinal hernia; reducible, complete, acquired, indirect, of 6 years' duration, following a fall from a horse, of immediate formation. Truss worn last 2 years. Has never been strangulated. Riggs' injection treatment, failure. *Lumbar kyphosis 1 year.* Operation 30-6-'98, Bloodgood; ether. Transplantation of rectus. Internal oblique muscle not divided; cord not transplanted. Wound closed, 3 mattress sutures, silver wire, including rectus and internal oblique. Catgut in aponeurosis of external oblique. Gloves worn. 4 ligatures, black silk on skin vessels. Veins not excised. *Class B. Conjoined tendon obliterated.* Ether well taken. Detail of operation: Skin incision a little lower than usual. Division of aponeurosis of external oblique. Internal oblique muscle wide and firm, not divided but dissected from coverings of sac and retracted upwards and *outwards*. Peritoneum opened above neck of sac. Examination from opening into peritoneal cavity. The neck of the sac admits two fingers, the tissues between the opening of the sac and outer border of the rectus are very thin and relaxed. The conjoined tendon, if present, is too thin and weak to be of any value. Internal oblique muscle retracted upwards and *inwards*. Sheath of rectus exposed, divided from the pubes upwards for a distance of 5 cm. In closing the wound the lower edge of the posterior sheath of the rectus and transversalis fascia was sutured to Poupart's ligament over the cord; this held the cord snugly in position, so that it would not be injured in passing the sutures of silver wire. The wound was then closed with 3 sutures of silver wire approximating the rectus muscle and its anterior sheath, the internal oblique muscle and the aponeurosis of the external oblique to Poupart's ligament and the aponeurosis of the external oblique. The lowest suture was passed just above the pubic bone and approximated the rectus muscle to Poupart's ligament, leaving a small space for the cord, which, however, did not seem to be constricted. The upper two sutures approximated the rectus muscle and its sheath, and the internal oblique muscle to Poupart's ligament and the external oblique, the aponeurosis of the external oblique was then approximated with a continuous suture of catgut. The cord had been separated preparatory to its transplantation. The operator decided afterwards to give the method of non-transplantation a trial; the position of the cord in the lower angle of the wound did not seem to interfere with the approximation of the rectus muscle. The peritoneum was cut across

above the neck of the sac and the opening closed with silk, the sac was then removed from above downwards in the usual way. It was large, walls thin, not adherent, dissection not difficult, testicle not drawn out of scrotum, sac empty. First case in which this method has been tried. Healing per primam. September 1, 1898, the patient writes that he is at work and the result is a perfect one. November 1898, examination, wound solid, testicle normal.

Case 19. Perfect result; examination March 1899, well, 8 months. New method, Case II; cord not transplanted; rectus transplanted.

Surgical No. 7850. W. D. P., aet. 47 years; sailor. Very large, right inguinal hernia; reducible, complete, acquired, indirect, of 9 years' duration, following a strain. Truss worn, of no value. Never strangulated. Operation 6-7-'98, Bloodgood; ether. Rectus muscle transplanted. Internal oblique muscle very thin and composed of three separate bundles, divided. Wound closed, 4 mattress sutures of silver wire. Catgut posterior sheath of rectus to Poupart's ligament over cord. Interrupted catgut in aponeurosis of external oblique and divided internal oblique muscle. Gloves worn. Class B. Conjoined tendon very narrow and thin. Details of operation same as Case 18. Healing per primam. The cord in this case was not disturbed. Veins not excised. Slight swelling of the veins followed operation. No thrombosis. Photograph of hernia No. 9. September 1, 1898, examination, wound solid, external ring closed snugly about cord, testicle normal, perfect result.

Case 20. Perfect result; September 1898, examination, well, 1 month. New method, Case III; cord not transplanted; rectus transplanted.

Surgical No. 7862. S. P., aet. 51 years; laborer. Very large, left inguinal hernia; reducible, acquired, direct, of 5 years' duration, slow formation, after an attack of coughing. Truss worn. Small, right inguinal hernia; reducible, incomplete, acquired, direct (?). Operation 8-7-'98, Bloodgood; ether. Left side: Rectus muscle transplanted. Internal oblique muscle strong, not divided. Wound closed, 5 mattress sutures, silver wire in muscle. Catgut in aponeurosis of external oblique. Ligation of deep epigastric vessels. Intestinal suture of colon. Small injury of 1 cm. made accidentally. Class B. Conjoined obliterated. Gloves worn. Details of operation same as Cases 18 and 19.

Case 21. Perfect result; March 1899, examination, 7 months. New method; rectus transplanted; undescended testicle transplanted into scrotum.

Surgical No. 7963. J. B. H., Jr., aet. 33; lawyer. Large, left inguinal hernia; irreducible, incomplete, congenital, undescended testicle, interstitial third variety. Small lump noticed in groin since childhood. During the last 6 months it has been larger and irreducible. Right testicle nor-

mal. Operation August 5, 1898, Bloodgood; ether. Cord not transplanted, veins not excised, testicle transplanted into scrotum, rectus transplanted, internal oblique muscle divided, wound closed, 4 sutures silver wire above cord and catgut in the sheath of rectus to Poupart's ligament to hold cord in place. Sac large, situated between the skin and aponeurosis, contents omentum, not adherent, excised; conjoined tendon wide and firm; internal oblique muscle wide and strong; ether well taken. The skin incision was made longer than usual; the subcutaneous fat was thick; the sac was opened into at once; it was large and situated between the aponeurosis of external oblique and deep abdominal fascia and extended from pubes upwards and outwards to a line between the anterior iliac spine and umbilicus. The sac wall was thin and not adherent; it was easily separated from the surrounding tissue. Sac did not extend into the scrotum. The external ring (which corresponded to the neck of the sac) was about 3 x 2 cm. in diameter; sac contained a large mass of omentum which was not adherent. This omentum was drawn out, ligated and excised. Occupying the dorsal portion of the sac one saw the gubernaculum of the testicle, but not the testicle itself. After separating the sac excision a portion, excising the omentum, the aponeurosis of external oblique was divided; the stump of omentum was then reduced. The testicle was then seen in the abdominal cavity; it could be drawn out 1 cm. beyond the external ring, but no further. It was small and partly developed. The internal oblique muscle was then divided in order to give more room to divide peritoneum and separate testicle from its attachments. Peritoneum was then divided and separated from the vas deferens and its accompanying vessels and the opening of the peritoneal cavity closed with a continuous cobbler's suture (Dr. Young). Separation of peritoneum from vas deferens and vessels was continued for a distance of 3 cm. beyond the point where the vas deferens and its vessels diverged from each other. This allowed the testicle to be drawn well out of the abdominal cavity. Although the conjoined tendon was wide and firm it was considered best, as cord could not be transplanted, to transplant the rectus. The scrotum was invaginated and testicle sutured in this position. Posterior sheath of the rectus was then sutured to Poupart's ligament over the cord holding it snugly in place; rectus muscle and divided internal oblique muscle were then carefully sutured with 4 mattress sutures of silver wire to Poupart's ligament. Skin was closed with silver wire and dressed with foil. Testicle was only transplanted to a position just below the arch of the pubes because a deeper transplantation would have placed too much tension on the vas deferens and its vessels. At a second operation it may be possible to transplant the testicle down into lower part of the scrotum. The transplantation of the testicle was performed at the request of the patient. Healing per primam. No complication followed operation.

Case 22. Perfect result. June 1899, letter, well, 1 year and 10 months.

Surgical No. 8030. W. B., aet. 48 years; waiter. Very large, left inguinal hernia; reducible, complete, acquired, indirect, of 22 years' duration. Slow formation. Truss not worn. Operation 22-8-'98, Cushing; ether.

Cord not transplanted. Veins not excised. Internal oblique strong, not divided. Conjoined tendon obliterated. Rectus muscle transplanted. Wound closed, six sutures of silver wire. Gloves worn. Healing p. p.

Case 23. Perfect result; examination April 1899, 6 months. Strangulated hernia; resection and immediate end-to-end suture of a gangrenous loop.

Surgical No. 8270. F. R. S., aet. 32; cigarmaker. Small, right inguinal hernia; strangulated 24 hours, acquired, indirect, not quite complete. Hernia of about 5 years' duration. The hernia, during these 5 years, has entered the sac only at rare intervals. Patient has not worn a truss. This is the first attack of strangulation. While at work 24 hours before admission the hernia appeared at the external ring and became irreducible. He suffered from pain, but continued to work. In 5 hours he became nauseated and vomited a little whiskey and ginger which he had taken. He passed a painful night, did not sleep, was nauseated, and vomited a good deal towards morning, and especially after taking a cup of coffee. He walked to the hospital. Examination on admission: Facial expression one of pain, no change in pulse or respiration, temperature not taken, general condition appears to be excellent. There was no nausea or vomiting during the hour between admission and operation. In the right inguinal region, protruding about  $2\frac{1}{2}$  cm. from the external ring, extending into the upper part of the scrotum, there is a small, sausage-shaped tumor. The mass is smooth, tense, presenting no irregularities, distinctly dull on percussion, quite tender on palpation, but not exquisitely so, no impulse on coughing, both testicles normal. No distention of abdomen nor tenderness, no oedema or redness of the skin, no frequency of micturition. Had a passage from the rectum 6 hours before admission. No rectal tenesmus. *Leucocytosis* 17,300. Operation at once, 26-10-'98, Bloodgood; ether. Resection of 6 cm. of gangrenous small intestine, end-to-end suture with a Halsted rubber bag, wound closed with 4 sutures of silver wire. Cord not transplanted, veins not excised. The internal oblique muscle was strong; it was divided for a distance of about  $4\frac{1}{2}$  cm. Conjoined tendon wide and firm. The aponeuroses of external oblique and internal oblique muscle were first divided and then peritoneum above the neck of the sac. On opening the peritoneal cavity, one could see a loop of small intestine entering the internal ring. It was not distended and there was no evidence of congestion. There was no constriction at the internal ring. The sac was divided from the internal ring downwards, exposing about 4 cm. of two portions of the small intestine, which showed no evidence of congestion or distention. Just at the position of the external ring there was a constriction. A pair of blunt-pointed scissors, curved on the flat, were introduced into the sac, and the ring of fibrous tissue divided. From this point the sac extended for a distance of about 3 cm. and contained a knuckle of intestine about 6 cm. in length, which had been so constricted that the distal portion was gangrenous. It was black in color and soft. There was no exudate from the peritoneal coat. The line of demarkation was sharp. There was no thrombosis of the mesenteric vessels—the mesentery not extending into the constriction. There were in the sac about 3 drachms of dark black fluid, in which there were no flakes

of fibrin. Cultures were not taken. No faecal odor. This loop of intestine was immediately withdrawn out of the sac. The mesentery of the loop, which was slightly more distended than its fellow, was short, prohibiting more than 6 cm. of this portion of the gut from being withdrawn from the abdominal cavity. About the intestine gauze was packed. The mesenteric vessels were ligated near the intestine and divided. The loop of gangrenous gut was then excised with 1 cm. of healthy intestine, and an end-to-end suture immediately done, with a Halsted dilatable rubber bag. After one row of mattress sutures was tied and cut the peritoneum was approximated over these sutures with a continuous suture of fine black silk. During the suture not more than a few drops of the contents of the bowel escaped. The intestine was washed with salt solution and returned to the abdominal cavity, the opening being packed with gauze. The small sac was then excised from above downwards. Surrounding the lower third of the sac there was a good deal of fresh inflammatory exudate, making the dissection from the vas deferens and its veins difficult. During the dissection the vas deferens was accidentally cut, the oedematous condition of the tissues interfering with its recognition. In making a complete excision of the sac the testicle was drawn partly from the scrotum. The tissues about the testicle and epididymis were distinctly oedematous. After the complete excision of the sac an end-to-end suture of the vas deferens was made and the testicle replaced in the scrotum, the gauze was removed from the abdominal cavity, the sutured gut withdrawn and examined. Its appearance was excellent. The abdominal cavity was flushed with 5 litres of normal salt solution, and 1 litre was left in the cavity. The opening in the peritoneum was then closed with a continuous suture of fine black silk and the wound closed after the usual method, with the exception that the cord and veins were not transplanted. It was considered best not to transplant the vas deferens on account of the end-to-end suture, but to leave it undisturbed with its vessels in the inguinal canal. The divided internal oblique muscle was drawn down almost to the symphyses pubes and held in that place with catgut, so that muscle lined the entire length of the wound. The condition of the patient at the end of the operation was excellent. Full time of operation one hour and fifty minutes. Full time of anaesthetic one hour and thirty-five minutes. Pulse before, during and after operation 95° to 100°. Convalescence practically uninterrupted, highest temperature 101.4°. No nausea or vomiting; gas passed per rectum at the end of 48 hours. Emphysema of the entire right half of the abdomen was noticed the next morning after operation and disappeared in 6 days. It gave no discomfort. The slight abdominal distention following operation disappeared in 3 days. Leucocytosis before operation 17,300, after operation, 19,600; 20 hours, 18,800; 48 hours, 9000. Following the operation the veins became thrombosed and a small haematoma 1 x 1 cm. found midway between the epididymis and the external ring. The swelling of the testicle was slight and the epididymis did not become indurated. The thrombosis had almost disappeared at the end of three weeks. The wound healed per primam except the lower end of the skin incision. The dressing having been loosened to examine the emphysema, the skin wire was allowed too much freedom and had slightly torn the skin incision. The subcutaneous fat became infected and an area like a small boil formed, which discharged pus a few days, but was completely healed in two weeks.

## Case 24. Perfect result; June 1899, letter, well, 7 months.

Surgical No. 8360. O. U., æt. 6 years. Large, left inguinal hernia; reducible, complete, congenital, of 10 months' duration, following a jump. A truss was worn for the first 4 months, since which time it has been discontinued, because it did not hold the hernia in place. It is very interesting to note that when the child was born there was a small, right inguinal hernia which was kept in place by a truss for 1 year. During the 5 years since a truss has been discontinued the hernia has not made its appearance and on examination nothing could be made out on the right side. Operation 28-11-'98, Bloodgood; ether. Veins not excised, cord not transplanted. Internal oblique muscle divided and transplanted. Wound closed with 2 mattress sutures of silver wire and one of catgut. Operator wore gloves. The sac was large and of the congenital variety. Walls very thin. The peritoneal cavity was opened above the neck of the sac through the divided internal oblique muscle and the peritoneum divided above the neck of the sac and the opening into the cavity closed with silk. The sac was then partially removed from above downwards. The part adherent to the cord was not disturbed, fearing injury to the small vessels. The vas deferens and its accompanying veins, which were not large, were left undisturbed in the inguinal canal. The sac contained omentum which was not adherent and which was reduced. Wound healed per primam. Following the operation there was no swelling of testicle, epididymis or cord.

## Case 25. Perfect result; March 1899, 2½ months, examination, testicle normal.

Surgical No. 8405. M. A., æt. 28; lawyer. Small, left inguinal hernia; reducible, incomplete. The sac was congenital and complete, of 4 years' duration, slow formation. A truss had been worn. When the hernia is reduced no difference can be made out between the size of, or the impulse at the external rings. At the first examination, more than two weeks ago, the hernia could not be found. It made its appearance at this second examination after the patient had walked about without a truss; one feels only a very small, soft mass entering the sac. Operation 8-12-'98, Bloodgood; ether. Cord not transplanted. Veins not excised. Internal oblique not divided, but transplanted. Wound closed with 3 mattress sutures of silver wire. Operator wore gloves. On dividing the aponeurosis of the external oblique, it was found that the internal oblique muscle was strong and that the conjoined tendon was wide and firm; that the triangle between the outer border of the conjoined tendon and internal oblique muscle was not larger than normal. The divided cremasteric muscle was found to be quite thick. On dividing in infundibuliform fascia the cord and the veins were exposed. On careful examination a very narrow sac with very thin walls was seen. On opening the sac it contained a small piece of omentum. The internal ring would hardly admit the little finger (about 5 mm. in diameter). The sac was of the congenital variety and its lumen corresponded to the size of the internal ring. The peritoneum was divided across above the neck of the sac and the sac was partly excised. The testicle was not withdrawn from the scrotum. The vas deferens and its vessels were not disturbed in their position in the

inguinal cord. There was no varicocele and no indication for the excision of the veins. The internal oblique muscle was approximated to Poupart's ligament and the outer border of the conjoined tendon with a catgut suture, dislocating it downwards and inwards. This muscle, with the aponeurosis of the external oblique and Poupart's ligament, was then approximated with three mattress sutures of silver wire.

Note.—This very small operation was performed in this case because there was no evidence of weakness at the internal ring; the hernia consisted simply of a very narrow congenital pouch of peritoneum into which now and then a small bit of omentum descended. The opening at the internal ring was not large enough to allow the entrance of a loop of intestine. The wound healed per primam. The convalescence was uneventful. Highest temperature 100.5°, the evening after operation. Absolutely no swelling of testicle nor induration of the epididymis followed operation.

### GROUP III. 20 CASES IN WHICH THE CORD HAS BEEN LIGATED AND EXCISED.

Case 1. Perfect result; last examination March 1896, 4 years 9 months. Wound suppurated. August 1898, letter, well, 7 years. Atrophy of testicle.

Surgical No. 1025. J. K., aet. 4; boy. Small, right inguinal hernia; reducible, complete, acquired, indirect, of 2 years' duration, following an injury. Has not worn a truss. Hernia gives no discomfort. Operation 26-6-'91, Halsted. The cord was very adherent to the sac and was accidentally torn during operation. It was not sutured or transplanted. Wound closed with silk. Highest temperature 104°, on the 4th day. Wound opened on the 5th day for suppuration. Healed by granulation in 5 weeks. April 1892, 10 months, examination, wound solid, scar only 5 mm. wide, complete atrophy of testicle. March 1894, 2 years and 9 months, examination, wound solid, no recurrence. March 1896, 4 years 9 months, examination, well, no return.

Case 2. Patient lost track of since operation.

Surgical No. 1467. C. S., aet. 28; baker. Medium, right inguinal hernia; not completely reducible, incomplete, acquired, indirect, of 12 years' duration, following lifting. Has worn a truss, which gives him a good deal of discomfort. Operation 11-3-'92, Halsted. Sac small, walls thin. Contents: adherent omentum, which was excised. The cord and veins were very adherent to the sac and could not be separated from it. They were ligated and excised. Wound closed with silk. Healing p. p. Highest temperature 101°. Patient lost track of.

Case 3. Perfect result; last report (letter) October 1894, 2 years. Testicle normal.

Surgical No. 1957. D. B., aet. 24; farmer. Double inguinal herniae. Left side: very large, reducible, complete, acquired, indirect. Right side: very

small, incomplete; present since birth. Has worn a truss until 4 months ago. The hernia on the left side gives a good deal of discomfort. Operation 13-1-93, Halsted. Sac large, contains omentum, which was not adherent. The cord was accidentally torn during operation. For this reason it was ligated and excised with the veins. Wound closed with silk. Healing p. p. Highest temperature 100.5°. Some induration of epididymis followed operation. October 1894, 2 years, patient writes that he is perfectly well. He rides horseback but has not done any heavy lifting. A perfect result.

Case 4. Perfect result; last examination December 1898, 5 years and 11 months since operation. Cord excised, because of age of patient and size of hernia; atrophy of testicle did not follow. For operation on the left side, see Case 6.

Surgical No. 1988. J. G., æt. 69; laborer. Large, right inguinal hernia; reducible, complete, acquired, indirect, of 4 years' duration, of rapid formation, following a fall. Also a large, left inguinal hernia; reducible, complete, acquired, indirect. Operation 10-1-93, Halsted. Sac very large, walls thick. Veins and cord ligated and excised. Wound closed with silk. Healing p. p. Highest temperature 100.5°. For 24 hours after operation there was a good deal of nausea and vomiting and some epigastric pain. No note of any induration of epididymis following operation. December 1893, returns for an operation on the right side, no evidence of recurrence on the left side, no change in the testicle. Examination October 1894, April 1895, May 1896, April, September and December 1897 and 1898; last examination 5 years and 11 months after operation: wound is solid, external ring closed, the vas deferens and its vessels are normal, and one could not tell that they had been ligated. The ligated stump is situated beneath the skin over the pubes and cannot be palpated; the epididymis is soft; the testicle is slightly enlarged by a very small hydrocele which appeared 1 year after operation and has not increased in size since.

Case 5. Complete recurrence; last examination August 1898, 4 years and 10 months. Direct hernia, conjoined tendon obliterated; healing per primam. The recurrence is shown in photograph No. 12, taken August 1897. Testicle normal.

Surgical No. 2615. A. O., æt. 53; carpenter. Medium, right inguinal hernia; reducible, complete, acquired, indirect, 3 years' duration, following heavy lifting. Has not worn a truss. Similar but smaller hernia on the left side. Operation 16-11-93, Halsted. Veins and cord ligated and excised; wound closed with silk. The sac was situated to the medial side of the deep epigastric vessels and protruded directly through the external ring, conjoined tendon being obliterated. The epigastric vessels were ligated. Healing per primam; highest temperature 101°. Slight diarrhoea followed operation, which lasted 3 days. October 1894, examination, 11 months: in Poupart's ligament, about 1.5 cm. above the spine, there is a split one cm. in length but no bulging or impulse; testicle is normal. March 1895, examination, 1 year and 3 months: through the split in

Poupart's ligament, noted in last examination, there is now a slight bulging impulse; testicle normal. March 1896, 2 years and 5 months, examination: bulging has not increased in size; patient considers himself well. January 1897, 3 years 1 month, examination: bulging has increased in size and is now as large as the original hernia; it is reducible. The split noted in Poupart's ligament has also increased slightly in size; the present enlargement was noticed by the patient 3 months ago. March 1897, August 1897, last examination 3 years and 10 months after operation: recurrent hernia has not increased in size; patient wears a truss. On examination of the hernia on the left side the obliteration of conjoined tendon can easily be demonstrated. August 1898, examination, no change.

Case 6. Slight bulging below the outer third of the scar. Last examination December 1898, 5 years 11 months after operation. The wound was opened within 24 hours, because of its distention with blood. The small bulging is shown in photograph No. 17. Testicle normal.

Surgical No. 2664. J. G., aet. 69; laborer (see also Case 4, same group). Large, left inguinal hernia, reducible, complete, acquired, indirect. Operation 12-12-'93, Halsted. Veins and cord ligated and excised. Wound closed with silk. Conjoined tendon wide and firm. Within 8 hours after operation temperature rose to 104° and 24 hours after operation wound was opened; it was distended with blood. On the 16th day a gravitation abscess formed in the scrotum. Patient was discharged in 5 weeks, the wound having completely healed in 4 weeks with the discharge of only one of the buried sutures of silk. Examination, March 1894, 2 months, both scars are 10 cm. long and of equal width, 2 to 3 mm. December 1898, 5 years 11 months: the left epididymis is still indurated. The right wound is solid and external ring closed. Below the outer third of the left wound there is a bulging 3 x 3 cm. in diameter; it is not reducible. The impulse on coughing over this bulging is very slightly, if any, more marked than over the rest of the abdominal wall. There is no opening to be made out. October 1894, 9 months, examination, no change, the induration of the left epididymis has disappeared, both testicles are normal except the small hydrocele on the right testicle, noted under Case 4. April 1895, May 1896, April and September 1897, examinations: bulging has not increased in size, result is practically a perfect one, patient considers himself cured.

Case 7. Perfect result; last examination September 1898, 4 years. Atrophy of testicle.

Surgical No. 3494. A. B., aet. 52; manufacturer. Large, right inguinal hernia; reducible, complete, acquired, indirect, of 20 years' duration. Has always worn a truss, which has completely retained the hernia until 3 weeks ago, since which time he has been unable to wear a truss. Operation 16-10-'94, Halsted. Subcutaneous fat very thick. Sac long, but small in diameter. Contents: omentum adherent only to the apex of the sac. The piece of omentum was excised. Veins small, excised. Cord ligated and excised. Muscle split. Wound closed with silver wire. Irri-

gated with 1 to 1000 bichloride. During the passing of the deep sutures the epigastric vessels were injured and required ligature. Healing p. p. Highest temperature 101°. Much induration of epididymis followed operation. For 4 days following operation the patient suffered from colic and marked distention of the abdomen, which produced some nausea. February 1895, 3 months, examination, wound solid; on the right side the testicle is one-half the size of the left, perfect result. August 1897, examination, 3 years, perfect result, atrophy of testicle, patient in excellent health, no discomfort since operation. September 1898, examination, perfect result.

Case 8. Perfect result; last report (by physician) July 1897, 2 years and 8 months after operation. Haemorrhage from the omentum at the operation; atrophy of testicle.

Surgical No. 3679. L. S., aet. 34; merchant. Large, right inguinal hernia; partially reducible, complete, acquired, indirect, of 12 years' duration, following heavy lifting. Five months ago the hernia was operated on; wound healed per primam. Patient got up on the 21st day. Nine weeks later, following an injury to the groin, the hernia returned. Operation 10-12-'94, Halsted. Sac was very large and contained mass of very adherent omentum, which was excised; directly after the reduction of the stump of ligated omentum there was a profuse haemorrhage. Median laparotomy was performed, the bleeding vessel found and tied; both wounds were dressed with silver wire after being irrigated with 1 to 1000 bichloride. A small gauze drain was placed in the hernial wound; it was removed in 24 hours; healing per primam; highest temperature 100°. Following the operation the testicle became rapidly very much swollen, and on discharge from the hospital 4 weeks after operation the testicle was enlarged and the epididymis and cord indurated. Three weeks after leaving the hospital a small abscess formed in the scrotum and two silk ligatures discharged. Complete atrophy followed in a few months. July 1897, report by physician, 2 years and 8 months after operation, both wounds are solid, testicle has atrophied.

Case 9. Perfect result; last examination February 1897, 1 year 10 months. Small hydrocele followed operation.

Surgical No. 4106. J. F. W., aet. 59 years. Small, double inguinal herniae; reducible, incomplete, acquired. (For operation of left side see Group I, Case 115.) Operation right side 19-4-'95, Halsted. Vas deferens and veins excised. Wound closed with silver wire. Healing p. p. Only a very little swelling of the right testicle followed, which disappeared in two weeks. January 1896, 9 months, examination, perfect result, testicle normal. February 1897, 1 year 10 months, examination, perfect result, testicle normal, small hydrocele has formed in the last month.

Case 10. Perfect result; last examination September 1897, 1 year 6 months. Atrophy of the right testicle.

Surgical No. 5262. (For history see Group I, Case 138.) Medium, right inguinal hernia; reducible, incomplete, acquired, indirect. In a man aet.

50 years. Hernia on both sides. Operation 30-3-'96, Bloodgood; ether. On the left side the cord was transplanted, and on the right side the veins and vas deferens were ligated and excised. The internal oblique muscle was too thin and too high to be divided. Wound closed with silver wire. Healing p. p. Highest temperature 101°. Marked swelling of the epididymis and testicle followed the operation. August 1897, letter, well, 1 year 5 months. September 1897, examination, 1 year 6 months, wound solid, right testicle atrophied.

Case 11. Perfect result; last report (letter) June 1899, 3 years 2 months. Atrophy of testicle.

Surgical No. 5287. J. R. T., aet. 56; insurance agent. Small, right inguinal hernia; reducible, incomplete, acquired, indirect. On the left side there is a distinct impulse at the external ring when the patient coughs. Of 1 year's duration, associated with enlarged prostate and difficult micturition. 4 years ago a calculus in the bladder had been removed through the supra-pubic incision, which has been entirely healed for 3 years and 8 months. Operation 2-4-'96, Halsted; ether. Right side: Sac small and excised. Veins and cord ligated and excised. Internal oblique muscle divided. Wound closed with silver wire. Left side: A small protrusion of peritoneum was found occupying the cord in the inguinal canal for about 1 cm. The veins were excised, and the pillars of the external ring sutured with silver wire, the cord being brought out above them. The aponeurosis of the external oblique muscle was not divided. Both wounds healed p. p. Highest temperature 101°. Following the operation there was much swelling of both testicles and the epididymis, and the mass of ligated veins on both sides was agglutinated together in one mass, in which the vas deferens could not be differentiated. 10 weeks after the operation there seemed to be beginning atrophy in both testicles (see also Group II, Case 8). December 1897, 1 year 8 months, letter, well, atrophy of testicle. August 1898, letter, well.

Case 12. Partial recurrence; last examination January 1897, 9 months. Conjoined tendon obliterated.

Surgical No. 5328. A. W., aet. 64. Very large, right inguinal hernia; strangulated, incomplete, acquired, direct. Hernia of 38 years' duration, following an injury. Although the hernia has been very large, it has never descended into the scrotum. A truss, after a number of trials, was discarded because it did not retain the rupture. The hernia has always been reduced with a good deal of difficulty and would frequently come down when the patient was asleep in bed and the pain would awaken him, and relief was only given by reduction. Three days (71 hours) before admission to the hospital the hernia became irreducible and four attempts at reduction were unsuccessful. Nausea and vomiting began 24 hours later. The patient was brought to the hospital after riding three miles in a wagon and 26 miles on the railroad. Examination on admission: Pulse 72, temperature 100°, facial expression good, no general abdominal distention or tenderness. Just over the external ring, but not descending into the scrotum, there is a tense tumor, 6 x 8 x 10 cm. in diameter. Oper-

ation 12-4-'96, Bloodgood, ether, one hour after admission into the hospital. Veins and cord ligated and excised, sac closed with silk, wound closed with silver wire. The details of the operation were as follows: Skin incision above the tumor; division of the aponeurosis of the external oblique and the internal oblique muscle; ligation and division of the deep epigastric vessels which were situated to the outer side of the sac. Opening of the peritoneal cavity above the neck of the sac. From the peritoneal cavity a blunt-pointed pair of scissors curved on the flat were passed between the intestines and the constricting neck of the sac. With this as a guide the sac was divided downwards for about 3 cm. The sac contained a large mass of intestines, dark in color, and there were haemorrhages in the mesentery, but the circulation soon returned. This large opening into the peritoneal cavity allowed of the easy reduction of the intestines. The opening in the peritoneal cavity measured 6 cm. in length. The sac of the hernia was of the direct variety, being situated to the medial side of the deep epigastric vessels and not being covered by the infundibuliform fascia. The conjoined tendon was completely obliterated; the medial side of the opening into the peritoneal cavity being formed by the rectus muscle. The sac was divided across at its neck and the opening into the peritoneal cavity closed with silk. The cord and veins were ligated and divided above the neck of the sac and then removed with the sac from above downwards and ligated for a second time on the side of the testicle. In closing the wound six mattress sutures of silver wire were used. The upper  $3\frac{1}{2}$  included the divided and transplanted internal oblique muscle. The lower  $1\frac{1}{2}$  sutures included the aponeurosis of the external oblique and the sheath of the rectus on the upper side and Poupart's ligament on the lower side. The last suture was passed as closely to the pubic bone as possible. The operator passed the lower sutures with the greatest care, because of the obliteration of the conjoined tendon, but it did not occur to him at this time to divide the sheath of the rectus and to transplant that muscle in the manner which he has done in later cases. Healing p. p.; highest temperature 100°. Very slight induration of the epididymis and some swelling of the stump of the ligated veins followed operation. Patient made an uneventful convalescence. January 1897, patient writes that he is perfectly well, and, although 64 years of age, is able to do his farm work better than he has for many years. January 27, 1897, the operator fearing that a recurrence might be expected in this case on account of the conjoined tendon, wrote the patient to return to the hospital for examination, paying his expenses. On standing and coughing the entire abdominal wound seems solid and does not bulge. On passing the index finger by invaginating the scrotum into the external ring, an opening could be felt about 1 cm. in diameter, bounded on the medial side by the sheath of the rectus and to the lower side by Poupart's ligament. Through this opening on coughing a small bulging and impulse could be made out. The remainder of the wound was solid. The patient considers the result perfect. Both testicles are equal in size. October 1897, one year and six months after operation, his physician writes that he has examined the patient carefully and can find no evidence whatever of a recurrence or a weakness in the wound. September 1898, death after severe injury. Physician reports that the hernia had not returned.

Case 13. Perfect result; April 1899, examination.

Surgical No. 5435. J. T., age 37. (For history see Group I, Case 141.) Operation 12-5-'97, Bloodgood; ether. Healing p. p. February 1897, patient lost track of.

Case 14. Perfect result; letter August 1898, 1 year 10 months.

Surgical No. 5993. L. O. F., aet. 54; clerk. Small, left inguinal hernia; strangulated 8 hours, incomplete, acquired, indirect, of a few years' duration. Patient was admitted to the hospital September 26, 1896, with an extensive eczema over the left groin, which seemed to be due to the truss. The eczema improved and he was allowed to go home, to return later for operation. The hernia remained reduced until 8 hours before his second admission to the hospital, when it suddenly descended and became irreducible. The pain in the groin was intense. Nausea and some vomiting present. The tumor in the groin was very tense and very tender and dull on percussion, the skin over it normal in color. Operation 7-11-'96, Bloodgood; ether. The sac was small and contained 50 cc. of blood-stained fluid and a loop of small intestine 8 cm. in length, which was quite congested and in places dark. It was returned. The veins and vas deferens were ligated and excised on account of the age of the patient. The wound was closed with 6 sutures of silver wire. Healing p. p. Highest temperature 101°. Absolutely no discomfort followed the operation. A very slight induration of the epididymis, but above the epididymis one could palpate the vas deferens and a bunch of veins. Above this and extending to the pubes, there was a small mass into which the vas deferens passed and could not be differentiated. There was no pain or tenderness in the testicle.

Note.—In this operation the aponeuroses of the external oblique muscle and internal oblique muscle and transversalis fascia were first divided above the neck of the sac, and through this opening the peritoneum was divided, opening into the general peritoneal cavity above the point of constriction; the constriction due to the neck of the sac was so tight that only with great difficulty could a pair of blunt, curved scissors be introduced between the gut and the sac, on which the constriction was divided, allowing the free opening of the sac, the sponging out of the fluid, and the reduction of the congested intestine with great ease. The peritoneum was then divided just above the constriction, and the rent sutured with silk. The remainder of the sac was removed, and the vas deferens and veins ligated and excised without removing the testicle from its position in the scrotum. This case also demonstrates that strangulation is more to be feared in small herniae, which only descend into the sac at intervals. In this case the patient was warned of the danger, but a truss could not be worn on account of the eczema, and an operation was contra-indicated until the eczema was cured. Fortunately, at the time of operation the skin was in a healthy condition.

March 1897, letter, well, 3 months. August 1897, examination, 9 months, perfect result, testicle normal, globus major contains a cyst 1.5 cm. in diameter, remainder of epididymis normal, no return of the eczema. October 1897, examination, 1 year, wound solid, no change in testicle, perfect result. August 1898, letter, well, 1 year and 10 months.

Case 15. Perfect result; last examination August 1897, 5 months. Very large hernia; direct; conjoined tendon obliterated; suppuration; acute infection; silver wire sinus. November 1898, letter, well, 1 year 8 months.<sup>1</sup>

Surgical No. 6316. J. C. W., aet. 46; engineer. Very large, right inguinal hernia; reducible, complete, acquired, *direct*, of 12 years' duration and of slow formation, following an injury to the groin. Has not worn a truss for 10 years. Patient is a very fat man, weighing 265 pounds, but in good health. The hernia measures 17 x 15 cm. An examination of the external ring after the reduction of the contents demonstrates a complete obliteration of the conjoined tendon. Operation 9-3-'97. Halsted. Ligation and excision of the vas deferens and its vessels. Division of the internal oblique muscle. Wound closed with silver wire, 6 sutures. The subcutaneous fat was very thick and vascular. After the division of the aponeurosis of the external oblique and internal oblique muscle, the coverings of the sac were divided in the direction of the testicle and during the dissection of the sac the testicle was drawn out of the scrotum. The dissection was performed from below upwards and it was found to be very difficult, due to adhesions to the testicle and cord, and on account of the vessels and fat in the walls of the sac. After the sac was completely isolated it was opened. The opening into the peritoneal cavity measured 5 cm., and extended well down to the sheath of the rectus and the arch of the pubes, the conjoined tendon being obliterated. The tissues forming the neck of the sac were quite thick and the opening was closed with 3 heavy white silk sutures. Before closing the wound it was decided to excise the cord. In closing the wound 3 of the deep sutures included the divided internal oblique muscle, and the last and lowest suture just above the arch of the pubes was made to include the sheath of the rectus. The operation had been a very difficult one and there was a good deal of shreds of lacerated tissue in the wound and some oozing. A small gauze drain was inserted in the lower angle of the wound just above the pubes. 8 hours after operation patient had a chill and temperature of 102°. The scrotum became rapidly very much swollen and its skin oedematous and ecchymotic. 36 hours after operation the temperature was 105°, pulse 132°, respiration 32'. The scrotum continued to swell, and there was leucocytosis of 21,000; no malarial organisms. The skin and subcutaneous wound was completely opened. It was found that the wound was distended with a blood-stained serum and that the scrotum was filled with blood. Microscopic examination of this fluid demonstrated numerous leucocytes, many of which contained cocci. Cultures on slant agar at the end of 24 hours showed white and yellow colonies of the staphylococcus, both of which liquified gelatine. Patient was placed in a continuous bath and remained there for 10 days. On the third day an area 3 x 3 cm. of the scrotum became discolored, at the end of 24 hours a definite line of demarcation had formed, and on the ninth day, with the necrotic testicle, separated spontaneously, after which the wound healed rapidly by granulation. Patient left the hospital at the end of 7

<sup>1</sup> March 1899, 5 months, recurrence in the upper angle of the wound noticed since January.

weeks in excellent health, wound having closed except 2 very small superficial sinuses. None of the buried sutures of silver wire discharged. The operation in this case was a very difficult one, due to the thickness of the subcutaneous fat and the large and very adherent sac. This case represents the only one in which the testicle and an area of the scrotum have sloughed. This may be explained by the fact that, in addition to the ligation of the cord, the testicle was drawn out of its bed in the scrotum, which may have injured that source of its blood supply. This also represents the first case closed with silver wire in which there has been acute infection. The result demonstrates the value of the early opening of the wound. July 1897, examination: wound solid, two sinuses still present, one silver wire suture discharged. August 1897, examination, 5 months: wound solid, two sinuses present, discharge scanty, absolutely no discomfort, health excellent, photograph.

Case 16. Perfect result; November 26, 1898, letter, 7 months. Cocaine anæsthesia.

Surgical No. 7623. D. M., æt. 67 years; laborer. Large, right inguinal hernia; reducible, complete, acquired, indirect, 10 years' duration, slow formation. Complete 6 weeks, following a cough. Truss worn. First attack irreducible 3 days ago, lasted 4 hours. General condition bad. Chronic bronchitis. Emphysema. Operation 21-4-'98, Cushing; *cocaine and morphia*. Cord excised. Wound closed, silver wire. Gloves worn. Internal oblique muscle divided and transplanted. Conjoined tendon wide and firm. Healing per primam. No swelling or tenderness of testicle or epididymis.

Case 17. Perfect result; March 1899, examination, 11 months. Atrophy of testicle.

Surgical No. 7652. J. J., æt. 39 years; laborer. Large, left inguinal hernia; strangulated 6 hours, complete, congenital hernia, 16 years, following strain. Frequent attacks of irreducibility. Truss worn. General condition excellent. Atrophy of testicle. Operation 27-4-'98, Cushing; cocaine and primary chloroform. Under cocaine: incision of sac and reduction of gut. Under chloroform: radical cure. Cord excised. Internal oblique muscle divided. Wound closed, silver wire. Gloves worn. Sac contained 18 inches of ilium congested and *chyle-like fluid*. Healing per primam. Some swelling and induration of testicle and epididymis, which had not disappeared on discharge.

Case 18. Perfect result. Cocaine anæsthesia. June 1899, letter, well, 1 year and 2 months.

Surgical No. 7769. G. W. C., æt. 67 years; cartdriver. Small, left inguinal hernia; reducible, incomplete, acquired, indirect, of 49 years' duration. Always reducible until 36 hours before admission. Symptoms of strangulation. Reduced during transportation to hospital. Operation 8-4-'98, Bloodgood; *cocaine*. Cord excised. Transplantation of rectus. Internal oblique muscle not divided. Closed 3 sutures, silver wire. Catgut

in aponeurosis. Silver wire in skin. Gloves worn. Sac and abdominal cavity contained clear fluid. Internal oblique muscle good. Conjoined tendon wide and firm. 10 hours after operation the dressings became saturated with blood. They were removed and the skin silver wire suture withdrawn. The haemorrhage seemed to be due to bleeding from a superficial subcutaneous vein which had not been ligated. There was also considerable oozing from the subcutaneous tissue following the cocaine injection. The wound was irrigated with salt solution, packed for one-half hour with iodoform gauze; at this time the oozing had completely stopped. The skin incision was then closed and dressed in the usual way. Some swelling of the testicle and thrombosis of the ligated veins followed operation. The wound healed absolutely per primam; the convalescence was uneventful. This patient had been operated on four years before for a strangulated, right inguinal hernia. (See Group IV, Case 6.) The result is a perfect one. September 1898, 3 months, examination, both wounds solid, perfect result.

Case 19. Perfect result; last report June 1899, from physician, 9 months since operation.

Surgical No. 8037. V. C., æt. 53. Small, recurrent hernia at the position of the transplanted cord. This patient was operated on in August 1897 (1 year ago), for a very large right inguinal hernia (see Group I, Case 196). At this operation the cord was transplanted *in toto* into the divided and transplanted internal oblique muscle. The veins, which were unusually large, were not excised. The rectus muscle was transplanted because the conjoined tendon was obliterated. The wound healed absolutely per primam. About 4 months after operation the patient felt some pain in the upper end of the incision. At that time he was suffering from a cough and attacks of sneezing. At the end of about a week he noticed a small bulging in the upper end of the incision. He consulted his physician, who advised a truss, which has been worn since. On examination, there is a slight bulging in the upper third of the old scar at the position of the transplanted cord. When this is reduced one feels an opening in the abdominal wall about 1 to 1.5 cm. in diameter. Operation 24-8-'98, Bloodgood; ether. Cord excised, internal oblique muscle divided and transplanted; rectus muscle transplanted. Wound closed with 5 mattress sutures, silver wire and catgut in the aponeurosis of the external oblique. Operator wore gloves. A small sac, about 1 cm. in diameter and 2.5 cm. in length, was found protruding through the abdominal wall above the transplanted cord. The diameter of the sac itself was not much larger than the diameter of the cord. It consisted of the vas deferens and a number of very large veins. Wound below the sac was strong. On separating the scar tissue it was found that the divided and transplanted internal oblique muscle, which had been sutured about the transplanted cord, was represented by scar tissue. It was through this scar tissue and above the cord that the recurrence had taken place, and it was without doubt caused by the enlarged veins. It was found that the transplanted rectus muscle had remained in position. Between its outer border and Poupart's ligament there were about 8 mm. of firm scar tissue. As the patient was 53 years of age, it was considered best to

ligate and excise the cord, and in order to get fresh muscle surfaces for suture the internal oblique was divided and transplanted and rectus muscle was separated from the scar tissue and again transplanted. The wound healed per primam. There was very little swelling of testicle and slight induration of veins following operation. January 1899 (3½ months after operation), his physician reports that the wound is solid and the patient is perfectly comfortable. Letter June 1899; well.

Note.—This case demonstrates the probabilities of an early recurrence at the position of the transplanted cord if the veins are not excised. It also demonstrates the value of the transplanted rectus muscle in the lower two-thirds of the wound.

Case 20. Perfect result; examination January 14, 1899,  $2\frac{1}{2}$  months. Cocaine anaesthesia. Death April 1899.

Surgical No. 8269. Dr. M. T., aet. 84 years. Small, left inguinal hernia; reducible, incomplete, acquired, 4 years' duration, following a fall. Truss worn for the last 3 months, which has not retained the hernia, and has given a great deal of discomfort. On July 5, 1898 (about four months ago), a very large right inguinal hernia was operated on under cocaine anaesthesia. At this time a large hydrocele was removed. The wound healed per primam. The result is a perfect one—so satisfactory, in fact, that the patient desires an operation on the left side. Operation 26-10-'98, Bloodgood; cocaine. Cord excised; internal oblique muscle not divided. Wound closed with 3 mattress sutures of silver wire, approximating internal oblique muscle and aponeurosis of external oblique to Poupart's ligament. The conjoined tendon was wide and firm. Gloves worn. The following notes were made during the operation: The skin incision was injected with 3 ii of a 1 per cent. cocaine and 3 iv of boiled water. The division of the skin was painless. Patient complained slightly of pain during the division of the aponeurosis of the external oblique and coverings of the sac. The dividing of the peritoneum gave no pain. Ligation of veins painful. Ligating the vas deferens was painless. It was found on opening the sac that a piece of omentum was adherent at the neck. It was considered best not to enlarge the opening into the peritoneal cavity. The omentum was left in its place and peritoneum closed over it. The introduction of the deep sutures was painless but the twisting was painful; suture of the skin was painless. The entire operation from the beginning of cocaine to the closure of the skin wound required 1 hour and 5 minutes. During the entire operation every strand of tissue was cut in small parts, nothing was torn. In dividing the skin the subcutaneous veins were dissected free and ligated in order to prevent any secondary haemorrhage. The wound was absolutely dry when it was closed; convalescence uneventful. Wound healed per primam. About 10 hours after operation patient became a little delirious and got out of bed for a moment. This same condition of mind was present about the same time after the operation 4 months ago, when the patient also got out of bed. January 14, 1899, examination, perfect result both sides, general health excellent. April 1899, see Group IV, Case 27, for cause of death.

## GROUP IV. CASTRATION. 27 CASES.

Case 1. Perfect result; last examination August 1898, 9 years. Castration because of injury to vas deferens.

Surgical No. 165. J. D., æt. 8. Small, left inguinal hernia; reducible, incomplete, acquired, indirect. Operation 9-8-'89, Halsted; ether. In dissecting out the sac the cord was injured. For this reason castration was done. Wound closed with silk. Small gauze drain removed at the end of 24 hours. Healing p. p. Highest temperature 100.5°. March 1892, 1 year and 5 months, examination, perfect result. March 1897, letter, well. August 1897 and 1898, examination, 9 years, perfect result.

Case 2. Perfect result; last examination March 1892, 1 year 4 months. Castration, undescended testicle.

Surgical No. 738. M. A., æt. 15. Small, left inguinal hernia; reducible, incomplete, acquired, indirect, associated with undescended testicle, of 2½ years' duration, following heavy lifting. Operation 28-11-'90, Halsted; ether. Sac contained fluid and omentum, which was excised. Testicle was removed. Wound closed with silk. Healing p. p. Highest temperature 99.5°. March 1892, 1 year and 4 months, examination, perfect result.

Cases 3-4. Perfect result; last examination December 1898, 5 years. Double castration, undescended testicles, adult.

Surgical No. 2514. J. E., æt. 43; merchant. Small, double, inguinal herniae; reducible, incomplete, acquired, indirect, associated with undescended testicle, of many years' duration. Has always worn a truss, which gives him a good deal of discomfort. Operation 18-11-'93, Halsted; ether. Both sacs small, not opened. Muscle split. Testicle and cord excised. Wound closed with silver wire. Irrigated with 1 to 1000 bichloride. Healing p. p. Highest temperature 102°. Some epigastric distention and pain followed operation, relieved by the use of the Paquelin. December 1895, 2 years and 2 months, patient has been examined frequently since operation; the result is perfect. February 1897 and August 1898, examination, perfect result. December 1898, examination, 5 years, perfect result.

Case 5. Perfect result; last examination June 1899, 5½ years. Very large irreducible hernia; stitch abscess (silk) 11th day; stitch sinus, 2 years 10 months.

Surgical No. 2616. C. H., æt. 38; laborer. Very large, left inguinal hernia; partially irreducible, complete, acquired, indirect, of 15 years' duration, following heavy lifting. Has a smaller, reducible hernia on the left side, which began 3 years ago. 3 years ago the left hernia became strangulated. Herniotomy was performed. The hernia recurred after operation. Operation 14-11-'93, Halsted; ether. The sac was very large, walls quite thick. Contents: intestine, 5 coils of which were adherent to the sac. After separation of the adhesions between the intestine and the

sac a number of peritoneal sutures were required to check haemorrhage from the torn surfaces. The cord and testicle were removed and the muscle split. The wound was closed with silk, but great tension was required to approximate the fascia. Wound healed p. p., except a small stitch abscess in the lower third, which was opened on the 11th day. December 1895, 2 years and 2 months, examination: there is yet a small stitch sinus present, which gives no discomfort. The scar has stretched a little, but as yet there is no recurrence. A remarkable result, considering the great size of the hernia and the poor tissues, which were approximated. January 1897, 3 years, wound solid, the silk suture discharged and the sinus closed 2 months ago. August 1897, examination, perfect result, operation for large, right inguinal hernia. (Group I, Case 189, Surgical No. 6728.) August 1898, examination, perfect result both sides. December 1898, examination, perfect result, 5 years.

Case 6. Perfect result; last examination January 1899, 5 years 2 months.

Surgical No. 2656. G. C., aet. 63. Large, right inguinal hernia; strangulated, complete, acquired, indirect, of 18 years' duration. Has been irreducible for 1 week. Symptoms of strangulation 4 days. Operation 25-11-'93, Bloodgood; ether. The constriction was in the centre of the sac. The intestine was in good condition and returned. The testicle and a small hydrocele and cord were excised. Muscle split. Wound closed with silk. The testicle was removed on account of the age of the patient and of the more perfect cure which could be accomplished. Healing p. p. Highest temperature 100°. 1 year later, perfect result. January 1896, letter, well, 2 years 2 months. January 1898 (see Group III, Case 18, for operation left side). August 1898, examination, perfect result.

Case 7. Perfect result; last examination July 1895, 1 year 6 months; last report (by letter) February 1897, 3 years.

Surgical No. 2787. E. W., aet. 46; farmer. Medium, right inguinal hernia; irreducible, incomplete, acquired, indirect, of 15 years' duration. Truss of no value. Rupture gives a great deal of discomfort. Operation 1-2-'94, Halsted; ether. The sac large, wall thin, especially at the neck. Contained omentum, which, being very adherent to the sac, was excised. Veins small, excised. Cord not transplanted as high as usual, because of its shortness. Wound closed with silk and a continuous subcutaneous copper wire suture in the skin. 24 hours after operation the testicle was found drawn up and firmly anchored above the scrotum. The patient was etherized again and the wound opened. Testicle and cord excised. The wound was then irrigated with 1 to 1000 bichloride and closed. Healing p. p. Highest temperature 100.5°. July 1894, 6 months, examination, perfect result. July 1895, 1 year and 6 months, examination, perfect result. February 1897, letter, 3 years, well.

Case 8. Perfect result; last report (by letter) August 1898, 4 years 4 months. Castration, undescended testicle.

Surgical No. 3017. T. H., aet. 10; schoolboy. Small, right inguinal hernia; reducible, congenital; present since 6 months of age. The testi-

cle is reducible with the hernia and never appears in the scrotum except with the hernia. The same condition is present on the left side, except that the hernia is much smaller and the testicle is larger. Operation 27-4-'94, Halsted; ether. Sac small. Testicle and cord excised. Muscle split. Wound closed with buried silk and silver wire in the skin. Irrigation with 1 to 1000 bichloride. Healing p. p. Highest temperature 99.5°. December 1895, 1 year and 8 months, perfect result. April 1896, letter, well, 2 years. March 1897, 2 years 11 months, letter, well. August 1898, letter, 3 years 4 months, perfect result.

Case 9. Perfect result; last examination August 1897, 3 years 3 months.

Surgical No. 3063. E. C., aet. 52; bookkeeper. Large, right inguinal hernia; reducible, complete, acquired, indirect, of 7 years' duration, following a strain. For the last year the truss has not retained the hernia and it has given great discomfort. Operation 15-5-'94, Halsted; ether. Sac large, ring very large. Testicle and cord excised. Muscle split. Wound closed with silver wire. Healing p. p. Highest temperature 101°. Castration was performed on account of the size of the hernia and the large ring and the age and consent of the patient. July 1894, 2 months, examination, perfect result. June 1895, examination, perfect result, 1 year. February 1897, letter, 2 years 8 months, well. March 1897, examination, 2 years 9 months, well. August 1897, examination, 3 years 3 months, perfect result.

Case 10. Perfect result; last examination June 1899, 5 years. Castration, undescended testicle.

Surgical No. 3128. G. L. H., aet. 24; medical student. Small, left inguinal hernia; reducible, incomplete, acquired, indirect, associated with undescended testicle; present since a young child. Has worn a truss with comfort. Wishes to be cured of the hernia and rid of the truss. Operation 2-6-'94, Halsted; ether. Sac very small, wall thin. Testicle, cord and veins ligated and excised. Wound closed with silver wire. Healing p. p. Highest temperature 100.5°. A great deal of epigastric pain and discomfort followed operation, greatly relieved by the use of the Paquelin. December 1895, 1 year and 6 months, examination, perfect result. August 1898, examination, 4 years 2 months, perfect result.

Case 11. Perfect result; last examination August 1897, 3 years. Castration because of size and strangulation of hernia.

Surgical No. 3345. J. G., aet. 44; driver. Large, left inguinal hernia; strangulated, complete, acquired, indirect, of 8 years' duration. Has been strangulated once before and reduced under chloroform. Present strangulation of 6 hours' duration. Operation 15-8-'94, Wirkmeister; ether. Sac large, walls thin. Contents: a large mass of omentum, which was excised, the intestines, which were in good condition, were reduced. Testicle and cord excised. Wound closed with silk sutures, passed through the skin. Healing p. p. Highest temperature 100.5°. Examination, 3 months later, perfect result. August 1897, 3 years, examination, perfect result.

## Case 12. Sudden death on the 7th day. Hernia strangulated.

Surgical No. 3357. M. S., æt. 44; lawyer. Medium, left inguinal hernia; strangulated, complete, acquired, indirect. Hernia of 21 years' duration. Has always worn a truss. There has been one previous attack in which the hernia became irreducible, and reduction was made under ether. The present attack began 3 days ago. Patient has not suffered from nausea or vomiting. He seemed in perfectly good condition. Operation 2-28-'94, Halsted; ether. Sac contained omentum only. It was very dark in color. It was excised; as the testicle was not developed it was excised with the cord. Wound closed with silver wire. Irrigation 1 to 1000 bichloride. Healing p. p. Highest temperature 99.5° (F.). Pulse rather slow, between 55 and 80. Patient was making an uneventful recovery when on the 10th day he raised himself a little in bed to write a letter and death took place at once from syncope. Autopsy No. 560. Extensive arterio-sclerosis of coronary arteries of the heart. General artero-sclerosis, chronic passive congestion of the kidneys, chronic myocarditis, with slight fatty degeneration of myocardia. No wound or peritoneal infection.

## Case 13. Perfect result; last examination December 1895, 1 year 2 months. Castration, injury to vas deferens.

Surgical No. 3485. P. D., æt. 64; laborer. Medium, right inguinal hernia; reducible, complete, acquired, indirect, of 3 months' duration, following lifting. Operation 25-10-'94, Bloodgood; ether. Sac small, walls very thick and very adherent to surrounding tissues. Contained a mass of omentum, which was excised. The tissues were so matted together about the neck of the sac that the cord was accidentally cut, after which the cord and testicle were excised. Muscle split. Wound closed with silver wire. Irrigated with 1 to 1000 bichloride. Healing p. p. Highest temperature 101°. December 1895, 1 year and 2 months, examination, patient works hard, perfect result. August 1897, lost track of.

## Case 14. Lost track of since operation. Very large hernia, injury to vas deferens; complete suppuration of wound (silk).

Surgical No. 4020. A. G., æt. 4. Very large, right inguinal hernia; reducible, complete, congenital; ring very large; present since birth. Not retained by truss. Operation 1-4-'95, Halsted; ether. Sac very large, walls very thick. Internal ring admits 2 fingers. Muscle thin. Testicle and cord excised, on account of the size of the hernia. Wound closed with silk. Temperature rose to 105° on the 4th day and the wound was completely opened for suppuration. Cultures from the pus demonstrated the infection to be due to *staph. pyog. aureus*. Patient discharged in 10 weeks, wound perfectly healed. March 1897, lost, letter returned.

## Case 15. Perfect result; last report (by physician) August 1898, 2 years 4 months. Very large hernia; castration for enlarged prostate; conjoined tendon relaxed.

Surgical No. 5207. G. W. C., æt. 58; mechanic. Very large, right inguinal hernia; reducible, complete, acquired, direct. Enlarged prostate,

requiring catheterization for retention of urine. Hernia of 2 weeks' duration, bladder trouble of 6 weeks' duration. First catheterization 10 days ago. Operation 19-3-'96, Bloodgood; ether. Sac very large, no adhesions. Cord and vessels ligated and excised with testicle. Internal oblique muscle divided, and used in closing the abdominal wound. The wound closed with silver wire. Left testicle removed through an incision in the left groin. Both testicles could have been removed through the incision made for the hernia on the right side, but it was considered best to remove the left testicle through an incision in the opposite groin, in order to ligate the vessels higher and without tension. The opening into the peritoneal cavity on the right side was about 5 cm. long, and without the divided muscle there would have been nothing but thin aponeurosis to suture over the opening into the abdominal cavity. Healing p. p. Highest temperature 100°. November 1896, February 1897, letter, perfect result. October 1897, 1 year 7 months, letter from physician, perfect result. August 1898, perfect result—hernia. Uses catheter three times a day.

• Case 16. Perfect result; last examination November 1898, 2 years. Castration because of undescended testicle.

Surgical No. 5962. D. A. N., aet. 19; clerk. Small, right inguinal hernia; reducible, incomplete, congenital; undescended testicle. The testicle has always been undescended. A reducible tumor was noticed in the groin one year ago. The appearance of the tumor followed an attack of cystitis, due to small calculi. A truss has been worn, which is serviceable, but the patient desires to be cured of his trouble. Operation 5-11-'96, Bloodgood; ether. Testicle undeveloped. It was excised with veins and cord. Internal oblique muscle divided. Wound closed with 5 sutures of silver wire, 4 of which included the internal oblique muscle. Skin closed with silver wire. Healing p. p. Highest temperature 101°. February 1898, examination, 1 year 3 months, perfect result.

Case 17. Perfect result; examination March 1897; letter August 1898, 1 year 9 months. Castration because of undescended testicle.

Surgical No. 5985. C. N. T., aet. 20; clerk. Small, left inguinal hernia; reducible, congenital, incomplete, associated with an undescended testicle. Hernia of one year's duration. Operation 7-11-'96, Halsted; ether. Castration. Closure of the wound with 5 sutures of silver wire; catgut in the skin. In this case before the division of the aponeurosis of the external oblique muscle, the sac and testicle were isolated and the sac opened. The sac contained omentum, which was adherent at one point: this small portion was ligated and cut and the omentum reduced. The vas deferens and its vessels were ligated near the neck of the sac, after which the sac and the testicle were removed and the opening into the peritoneal cavity closed; then the aponeuroses of the external oblique and internal oblique muscle were divided. The latter was thick and was included by most of the sutures in closing the wound. The position of the sac in this hernia was very interesting. The sac, after passing out of the external ring, did not descend into the scrotum, but extended upwards between the deep fascia and the aponeurosis of the external oblique

muscle. It was this portion of the sac that contained the testicle. The testicle could not be pushed into the external ring. The abdominal opening of the sac was but 1 cm. in diameter. Healing p. p. Highest temperature 100°. February 1897, 3 months, patient writes that he is perfectly well. August 1897, physician reports perfect result. November 1897, examination, perfect result, 1 year. August 1898, letter, well, 1 year 9 months.

Case 18. Perfect result; examination January 1899, 2 years 1 month. Very large hernia. Patient aet. 74 years.

Surgical No. 6066. J. D. S., aet. 74; farmer. Very large, right inguinal hernia; reducible, complete, acquired, indirect, of 20 years' duration. Truss has been of little value. Patient's general health excellent and vigorous. Operation 5-12-'96, Halsted; ether. Castration. Wound closed with 5 sutures of silver wire. Operation was not a difficult one. The subcutaneous fat was not very thick. The aponeurosis of the external oblique was divided, then the coverings of the sac, after which the sac, testicle and cord were rapidly shelled out. The vas deferens and vessels were isolated and ligated near the neck of the sac, the sac and the cord were then cut across and the opening into the peritoneal cavity closed with silk. The internal oblique muscle was then divided and the wound closed with silver wire. There is no note on the condition of the conjoined tendon. Healing absolutely p. p. Highest temperature 100.6°. Convalescence uninterrupted. Patient got out of bed at the end of the 3rd week and left the hospital 23 days after the operation. February 1897, 2 months, patient writes that he is perfectly well. August 1897, 8 months, patient writes that the result is perfect; general health excellent; in active business. May 1898, examination, perfect result. January 1899, examination, well, 2 years 1 month.

Case 19. Perfect result; last examination August 1898, 1 year 4 months. Recurrent inguinal hernia; conjoined tendon obliterated. Rectus muscle transplanted.

Surgical No. 6477. F. D., aet. 54; carpenter. Medium, right inguinal hernia. Symptoms of strangulation for 62 hours. This patient was operated upon in this hospital June 25th, 1891, by Dr. Halsted. (See Group I, Case 22, Surgical No. 1046.) At the operation 6 years ago the sac of a large hydrocele was also excised. The wound was completely opened on the 4th day because of suppuration due to haemorrhage; healed by granulation in 10 weeks, but there was a sinus in the lower angle of the wound which did not close for 6 months. Some or all of the deep sutures of silk discharged. Patient remained perfectly well for 5 years and 6 months. In January 1897, he suffered from an attack of bronchitis. In February he noticed after a severe fit of coughing a bulging in the lower angle of the wound just above the pubes. April 10th, 1897, patient presented himself for examination. There was an irreducible swelling in the lower angle of the wound just above the pubes, which did not extend into the scrotum. There was a distinct impulse on coughing. The epididymis was indurated but the testicle seemed normal in size. There was quite a mass of scar tissue in front of the swelling. Operation was advised. Patient was admitted April 23rd, 1897, at 10 P. M., with symptoms of strangula-

tion which had been present 62 hours. Operation at once, Bloodgood; ether. Castration. Closure of the wound with 7 sutures of silver wire. The incision was made through the old cicatrix. The aponeurosis of the external oblique was divided, and then the internal oblique for 3 cm. above the sac. The peritoneal cavity was opened above the neck of the sac and a pair of blunt scissors curved on the flat was passed into the sac between the constriction and the intestines. The constriction was then divided from above downwards and the sac also divided for about 2 cm. The sac contained a knuckle of small intestine, congested, and a good deal of blood-stained serum, but there were no adhesions between the peritoneal surface of the gut and the surface of the sac. The sac was then at once cut across and the opening into the peritoneal cavity closed. It was found that the conjoined tendon was completely obliterated. The sac was then removed with the testicle and all the scar tissue above and below the pubes. The vas deferens and vessels were imbedded in this scar tissue; their position was below and to the outer side of the sac, but it could not be made out that any muscular tissue surrounded them—only scar tissue. Then the wound was closed. The operator had removed every bit of scar tissue, so that he had for suture fresh-cut surfaces of the aponeurosis of the external oblique and internal oblique muscle, which were thick, Poupart's ligament and the rectus muscle, because in this case the operator divided the sheath of the rectus muscle from the pubes upwards for 3 cm., so that when the wound was closed with the sutures of silver wire the free border of the rectus muscle, as well as its sheath, was approximated to Poupart's ligament for a distance of 3 cm. above the arch of the pubes (the operator's method for the treatment of hernia when the conjoined tendon is obliterated). The aponeurosis was approximated with a continuous suture of catgut and the skin was closed with silver wire. The healing was absolutely p. p. Highest temperature 101°. Convalescence uneventful. The incision measured 12 cm. in length. Castration was performed in this case because of the age of the patient and the recurrence of the hernia. The recurrence of the hernia in this case took place in that portion of the wound in which there was the most scar tissue and in which a sinus had persisted for 6 months. The cord had nothing to do with the recurrence of the hernia, as it was situated some distance to the outer side of the sac, and between it and the opening into the peritoneal cavity there was strong scar tissue which had not yet given way. It was difficult to make out at the operation whether there was any muscle about the transplanted cord. Without doubt, the suppuration which followed the first operation would produce so much scar tissue as to mask the anatomical relations of the parts. There was no note made at the first operation on the condition of the conjoined tendon. At this operation the operator for the first time divided the sheath of the rectus in order to get a raw muscle surface as well as fascia to suture to Poupart's ligament in that portion of the abdominal wound weakened by the absence of the conjoined tendon.

Case 20. Perfect result; last examination April 1899, 1 year 11 months. Small direct hernia, plastic on rectus muscle; also operation for femoral hernia and epithelioma of penis.

Surgical No. 6572. L. K., aet. 64. Small, right inguinal hernia; reducible, incomplete, acquired, direct, of 11 years' duration, following strain.

Has never worn a truss. Patient was admitted to the hospital with an epithelioma of the penis, with metastasis to the glands in the right groin. Operation 31-5-'97, Bloodgood; ether. After a complete removal of the glands with an area of adherent skin, it was found that the patient had a small, right inguinal hernia and a small femoral hernia. The sac of the inguinal hernia came out through an opening in the conjoined tendon, which measured 1.5 centimeters in diameter. The portion of the conjoined tendon to the outer side of the opening was a firm, fibrous band about a centimeter in width; the portion of the conjoined tendon between the opening and the sheath of the rectus measured 2 cm. The operation for the inguinal hernia consisted of castration, the excision and closure of the sac, the division of the aponeurosis of the external oblique muscle and internal oblique muscle. In closing the wound the internal oblique muscle was transplanted as far as the outer border of the conjoined tendon. The lower two sutures included the conjoined tendon, and the last suture the sheath of the rectus, which, however, was not opened. The operation for femoral hernia consisted of the excision of the sac and closure of the opening into the peritoneal cavity, after which the entire skin wound was closed with a piece of gauze packing extending down to the sutured femoral sac. The closed wounds healed p. p. The cavity left by the gauze packing healed by granulation in 4 weeks. None of the buried silver sutures discharged. Highest temperature 101°. Castration was performed here, not on account of the hernia, but on account of the infiltration of the new growth from the groin into the right side of the scrotum. September 1897, examination, perfect result, no return of hernia or epithelioma, 4 months. November 1897, examination, perfect result, 6 months. August 1898, examination, perfect result.

Case 21. Perfect result; last report (letter) August 1898, 1 year 2 months. Castration for enlarged prostate.

Surgical No. 6632. A. F., aet. 64. Medium, right inguinal hernia; complete, reducible, acquired, indirect, of 20 years' duration. Has always worn a double truss with great comfort. Patient was admitted to the hospital, however, suffering from symptoms of enlarged prostate and cystitis, but it was considered best to operate for the cure of the hernia at the same time that castration was performed. Operation 17-6-'97, Halsted; ether. Double castration. Incision in the groin similar to those for hernia. On the right side the operation for hernia was also performed. Excision of the sac and suture of the opening into the peritoneal cavity with heavy black silk. Closure of the wound with 5 mattress sutures of silver wire and silver wire in the skin. The conjoined tendon was wide and firm. The internal oblique muscle was situated too high and for this reason was not divided. The subcutaneous fat was very thick and there was a good deal of fat in the inguinal canal. The only tissues that were approximated were the divided aponeurosis of the external oblique muscle and Poupart's ligament. The condition of the sac was a very interesting one. The sac was large and extended down to the testicle. Between the sac and the cord there was a large mass of properitoneal fat at least 12 cm. long and from 4 to 5 cm. in width. On examining the sac from above before opening it this fat could be seen shining

through, and it was considered that it was an omental hernia; on opening the sac this mass of fat projected into it from its lower and medial side, but the fat was found to be covered by the peritoneum and did not communicate with the peritoneal cavity. It, however, extended in front of the transversalis fascia in the direction of the bladder. It was excised with the sac. The blunt end of a large, curved needle was used in order to avoid injuring the vessels in this fat. The stump of this mass of fat after excision measured 2 by 3 cm., and was situated below and to the medial side of the sutured neck of the sac, the cord being situated below and to the outer side of this fat. Highest temperature 101°. Healing of both wounds absolutely p. p. Convalescence uneventful. August 1897, letter, hernia wound solid, catheter still used, 2 months. November 1897, letter, no recurrence of hernia, catheter still used, 5 months. August 1898, letter, no recurrence of the hernia, still uses the catheter.

Case 22. Perfect result; letter August 1898, 1 year. Castration because of size of hernia and age of patient.

Surgical No. 6820. W. M. H., railway engineer; æt. 50. Very large, left inguinal hernia; partly reducible, complete, acquired, indirect. Hernia of 29 years' duration. Until three months ago the hernia has been small and incomplete. In June, 1897, the patient fell, striking against a piece of timber, the injury being in the left groin. Following the injury there was a great deal of pain. In a few days the hernia became larger and descended into the scrotum. Has never worn a truss. No attacks of strangulation. The patient is very stout and subcutaneous fat is very thick. The hernia on the left side was partly reducible. When the patient stands the circumference of the mass in the scrotum is 40 cm. On the right side there is a small, reducible, incomplete, inguinal hernia. The left testicle is smaller than the right. Operation 13-8-'97, Finney; ether. Castration and excision of the sac. Wound closed with five silver wire sutures. The upper two only included the divided internal oblique muscle. The sac contained the intestines, which were not adherent. Behind the sac there was a large mass of adherent properitoneal fat, which was excised. There is no note on the condition of the conjoined tendon and no note whether the conjoined tendon was included by the last sutures. It is noted that the internal oblique muscle was thin and infiltrated with fat, so that it was of little value in closing the wound. Healing p. p. Following the operation there was an attack of pneumonia, the symptoms beginning about ten hours after operation. The highest temperature, however, was only 101°. Highest pulse 124. Highest respiration 42. There was a good deal of cyanosis. Moist rales could be heard over both sides of the chest behind, and there were signs of a small consolidated area in the right base. It was increased slightly for two or three days. Patient left the hospital in three weeks, having recovered perfectly from the operation and pneumonia.

Case 23. Perfect result. Castration because of undescended testicle. June 1899, letter, well, 1 year and 7 months.

Surgical No. 7045. H. A. L., æt. 30; storekeeper. Small, left inguinal hernia, associated with undescended testicle; reducible, incomplete, con-

genital. The hernia was first noticed when the patient was 12 years old, 18 years ago. Until the appearance of the hernia the testicle had never been noticed either in the scrotum or groin. The hernia or testicle has not descended beyond the pubic bone. The patient is able to push the testicle back into the abdomen or draw it down out of the external ring, but not further. Sometimes when the patient is walking the hernia and testicle suddenly descend, the descent is accompanied with a good deal of pain in the groin and the feeling of faintness and nausea. During these attacks he frequently goes to bed. Has worn a double truss, which has not given him much discomfort. Operation 8-11-'97, Bloodgood; ether. Castration. Division of the internal oblique muscle. Wound closed with four sutures of silver wire, including the rectus muscle, because the conjoined tendon was a very thin and weak structure. After the division of the aponeurosis of the external oblique and the internal oblique muscle the congenital sac was opened into, cut across at the neck and the opening of the peritoneal cavity closed with silk. It was then found that the conjoined tendon was very thin and weak, although not narrow. For this reason it was considered best to do the plastic operation on the rectus as described in cases. The testicle was removed both because the patient desired it and because it would have been difficult to have transplanted it into the scrotum. In closing the wound, broad muscle surfaces of divided internal oblique muscle and the rectus muscle were approximated down to the pubic bone. Operator wore gloves. Wound healed absolutely p. p. Highest temperature 101.5°. No abdominal distention followed operation. Convalescence uneventful. The patient is very neurasthenic and suffers with the delusion that the hernia has already returned.

Case 24. Perfect result; March 1899, letter, 1 year 1 month.

Surgical No. 7447. J. G. B., æt. 25 years; machinist. Very large, right inguinal hernia; strangulated 36 hours, complete, congenital, of 20 years' duration, following whooping-cough. Hernia and undescended testicle entered scrotum 10 years ago. Truss worn 2 months. Irreducible 16 hours. (Truss off.) Symptoms of strangulation at once. Operation 22-2-'98, Cushing; ether. Castration (atrophy of testicle). Wound closed, silver wire. Gloves worn. Internal oblique muscle good, divided, transplanted. Conjoined tendon wide and firm. Contents: sac 18 in., small intestine, very congested. Mesenteric vessels apparently thrombosed. 1 oz. straw-colored fluid constriction at neck of sac. Castration performed because of atrophied testicle. Healing per primam.

Case 25. Perfect result. Tuberculosis of sac and omentum. June 1899, letter, well, 1 year and 2 months.

Surgical No. 7555. W. F., æt. 39 years; cooper. Large, right inguinal hernia; irreducible, complete, acquired, indirect, 21 years' duration. Immediate formation after heavy lifting. Complete 4 weeks, following a strain. Irreducible 4 days. No symptoms of strangulation. Truss worn 6 months. No symptoms of tuberculosis of lungs or peritoneum. Operation 2-4-'98, Cushing; ether. Castration. Transplantation of divided internal oblique muscle and rectus muscle. Wound closed, silver wire. Gloves worn. Sac very thick, contents adherent omentum, excised. Tuberculosis of sac and

omentum. Slight evidence of tuberculosis of intestines. Healing per primam. Slight ecchymosis of scrotum.

#### Case 26.

Surgical No. 7770. (See Group II, Case 15, Surgical No. 7196.) Perfect result. Examination March 1899, 1 year. Rectus muscle transplanted because the conjoined tendon was obliterated.

Case 27. Perfect result; January 1899, examined, 6 months. Very large hernia, operation under cocaine anaesthesia. Death May 1899. No recurrence.

Surgical No. 7861. Dr. M. T., aet. 83 years and 6 months; married, physician. Admitted July 5, 1898, with very large, right inguinal hernia; reducible, complete, acquired, indirect, of 37 years' duration (aet. 46), following an injury to the groin. At the time of the injury he had pain and 3 days later noticed a tumor. In a few years it extended into the scrotum; he has worn a truss ever since, but for the last 10 years the hernia has not been retained by the truss, and it has given him some discomfort and he is troubled with constipation. 22 years ago (15 years after first appearance of hernia) he noticed a hydrocele on the same side (right). This hydrocele has been tapped a number of times. The hernia has never been strangulated. The patient's general health has been excellent. At present he is 83 years and 6 months of age; there is no excess of fat in any part of the body; marked arcus senilis is present; the radial arteries are tortuous and calcified; pulse 60; lungs clear; does not suffer from shortness of breath or cough; first sound of the heart at the apex is double and replaced by murmur; cardiac compensation perfect; urine normal. The hernia is of very large size, as shown in the photograph; it is easily reduced. When the hernia is reduced, the index finger invaginating the scrotum finds the external ring large, and finger on passing external ring meets no obstruction. If patient is asked to raise his head while finger is in this position, outer border of the rectus is distinctly felt, and obliteration of conjoined tendon easily demonstrated. Patient is very anxious to be cured of his hernia, which has given him a good deal of trouble. On account of his age an anaesthetic was advised against and he decided to have the operation performed under cocaine. Operation July 6, 1898, Bloodgood; cocaine. Castration, rectus transplanted. Wound closed with 3 mattress sutures, silver wire, catgut in the aponeurosis of the external oblique and silver wire in the skin; gloves worn. Patient was given a light breakfast and coffee. Full time of operation from the beginning of the skin incision to the end was 1 hour and 20 minutes. Operation had to be performed very deliberately, as sac was very large and there were a great many small vessels that had to be clamped and tied. Patient was first given one-eighth of a grain of morphia hypodermically. Skin incision was injected with 30 minimis of a 1 per cent. solution cocaine and 4 oz. of boiled water; at the end of 5 minutes skin incision was made—patient complained of no pain. There was very little if any subcutaneous fat, and aponeurosis of external oblique was at once exposed. This aponeurosis over the inguinal canal showed a definite thinning;

aponeurosis was divided from the position of the external ring upwards and outwards for a distance of about 6 cm.; the division of this fascia gave some pain. Aponeurosis was then caught with long sutures of heavy black silk and reflected outwards. The inguinal canal nerve was exposed, and cocainized; the fascia covering the sac was then divided without preliminary division of the internal oblique muscle exposing the sac of hernia; the testicle, hydrocele and cord were drawn out of scrotum and separated from the sac. This dissection, especially in dissecting sac of hydrocele from the base of the scrotum, gave pain; after separating the cord from the neck of the sac the veins and vas deferens were ligated; on tying the ligatures about the veins patient complained of pain, but after ligatures were tied, divisions of the veins and cord gave no pain. After this division cord, the testicle and hydrocele were easily removed, the sac was then separated little higher and opened; it was empty and the opening into the peritoneal cavity at the neck of the sac admitted easily 4 fingers, about 4 cm. in diameter. At this stage of operation it was easily demonstrated that between the neck of the sac and the outer border of the rectus muscle there was nothing but thin and easily stretched tissue, the conjoined tendon being completely obliterated. The opening into the peritoneal cavity was closed with heavy black silk and the sac excised—this procedure gave no pain. The aponeuroses of the external and the internal oblique muscle were retracted upwards and inwards, sheath of the rectus muscle exposed and divided, rectus muscle caught with two sutures of heavy black silk and drawn outwards. The wound was then closed by suturing the rectus, internal oblique muscle and aponeurosis of the external oblique muscle on the upper and medial side to Poupart's ligament, and the aponeurosis of the external oblique on the outer and lower side, so that the entire wound was lined with muscle; 3 mattress sutures of silver wire were sufficient. The insertion of these wires gave no pain; however, when the wires were drawn home and twisted, patient complained of pain; the aponeurosis of the external oblique was then more snugly approximated with a few sutures of catgut; in the deeper wound a few small vessels required ligatures of fine black silk. In dividing the sheath of the rectus to expose the muscle, 3 branches of the deep epigastric vessels were met with and required ligatures; in the skin, 4 veins were tied—2 on each side. At the end of the operation there was still a good deal of oozing from the subcutaneous tissue, which had been made edematous by the injections of cocaine and water. The wound, however, was loosely closed with silver wire and covered with wet bicarbonate gauze. The patient was placed in bed, made comfortable and left in the operating room. At the end of an hour and a half there was still some oozing from the wound; for this reason skin wire was removed and 2 small bleeding points found and tied, but even at this time there was still little oozing from the subcutaneous tissue; for this reason, in closing the skin the second time with a subcutaneous suture of silver wire, a small gauze drain was introduced, which was removed at the end of 24 hours. Patient's pulse at the beginning of the operation was 60; on one occasion, 15 minutes after cocaine had been introduced pulse rose to 85 and in 15 minutes returned again to 60, and remained between 60 and 66 to the end of the operation. Although patient complained of some pain during operation it never was unbearable, and he expressed himself as very much pleased with the result, not only during operation, but after-

wards. During the operation he drank a little coffee and some milk, directly after operation he took more nourishment. At the end of operation morphia (one-twelfth grain) was given hypodermically and patient fell asleep; 6 hours after operation the operator saw him in the wards; he was perfectly comfortable, having had his supper; he complained of no pain and did not appear at all shocked by the operation. Convalescence was uneventful.

May 14, 1899. Patient died in the hospital two weeks after an operation (excision of the upper jaw for carcinoma). At the autopsy the entire lower abdominal wall was removed and the tissues placed in Kaiserline.

Both hernia wounds were absolutely solid.

The rectus muscle, which was transplanted on the right side, appeared to be in place. Later these tissues will be carefully studied and a report made.

#### GROUP V. INGUINAL HERNIA, FEMALE. 39 CASES.

Case 1. Perfect result; last examination June 1897, 7 years 4 months.

Surgical No. 330. L. B., æt. 27; married. Small, right inguinal hernia; reducible, incomplete, acquired, indirect, of 22 years' duration, following the opening of an abscess in the groin. Operation 14-2-'90. Halsted; ether. Excision of sac and round ligament. Muscle split. Wound closed with silk. Healing p. p. Highest temperature 100°. November 1894, 4 years and 10 months, examination, perfect result. Has also a laparotomy wound in the median line, having been operated on since by Dr. Kelly. This wound also is solid. June 1897, examination, 7 years 4 months, perfect result, patient very stout.

Case 2. Patient lost track of since operation.

Surgical No. 481. E. P., æt. 45; widow. Small, right inguinal hernia; reducible, incomplete, acquired, indirect, of 5 years' duration, following lifting. Truss of no value. Operation 29-5-'94, Halsted; ether. Excision of sac and round ligament. Ligation of veins. The sac contained the ovary and tube, which were reduced. Muscle was split. Wound closed with silk. Healing p. p. Highest temperature 101°. Patient lost track of. March 1897, lost.

Case 3. Perfect result; last report (letter) September 1897, 7 years. Muscle not divided.

Surgical No. 598. D. H., æt. 9. Small, left inguinal hernia; reducible, incomplete, acquired, indirect, of 6 weeks' duration, following an injury. Operation 23-8-'90, Halsted; ether. Excision of sac and round ligament. Muscle not split. Wound closed with silk. Healing p. p. Highest temperature 100°. March 1894, 3 years and 7 months, letter, perfect result. January 1897, letter, perfectly well, 6 years 4 months. September 1897, letter, well, 7 years.

Case 4. Perfect result; last examination August 1897, 6 years 8 months. Cord excised; muscle not divided.

Surgical No. 722. E. L. P., aet. 7. Small, right inguinal hernia; reducible, incomplete, acquired, indirect, of 2 months' duration. Operation 21-11-'90, Halsted; ether. Excision of sac and round ligament. Muscle not split. Wound closed with silk. Suppuration of the skin in the middle third of the wound, which healed by granulation. Highest temperature 102°. March 1894, 3 years and 4 months, examination, perfect result. January 1897, letter, well, 6 years 2 months. August 1897, examination, 6 years 8 months, perfect result.

Case 5. Perfect result; last examination August 1897, 6 years 7 months. Typical operation.

Surgical No. 802. F. H., aet. 40; single. Small, right inguinal hernia; reducible, incomplete, acquired, indirect; strangulated 1 year ago for a few hours; reduced under chloroform. Of 8 years' duration. Has worn a truss, which gives much pain and discomfort. Operation 23-1-'91, Halsted; ether. Sac very small, excised. Round ligament and muscle cut. Wound closed with silk. Healing p. p. Highest temperature 101°. February 1894, 3 years, letter, perfect result. February 1897, letter, well, 6 years. August 1897, examination, 6 years 7 months, perfect result (married).

Case 6. Perfect result; last examination August 1897, 6 years 5 months. Direct hernia; bladder opened and sutured; wound left open.

Surgical No. 889. E. K., aet. 27; married. Small, left inguinal hernia; reducible, incomplete, acquired, direct, of 2 years' duration, following heavy lifting. Has given very little discomfort. Operation 13-3-'91, Halsted; ether. Excision and closure of sac. A second sac was found below and to the median side of the closed hernial sac. This was opened and proved to be the bladder, which was immediately sutured. No sutures were placed in the wound, but it was left open to heal by granulation. Wound healed in 6 weeks. Highest temperature 100.5°. There was no leakage from the suture of the bladder. March 1892, 1 year, examination, wound solid, well. April 1894, 3 years, examination, the scar is 1 to 2 cm. wide and soft. Seems to have stretched some. The wound seems solid. Perfect result. March 1897, 6 years, letter, well. August 1897, examination, 6 years 5 months, perfect result.

Case 7. Patient lost track of since operation.

Surgical No. 1617. C. C., aet. 16: single, colored. Large, left inguinal hernia; reducible, incomplete, acquired, indirect, of 2 years' duration. Has not worn a truss. Operation 27-5-'92, Baltzell; ether. Excision and closure of sac. Excision of round ligament. Muscle not split. Wound closed with buried silk in the fascia and continuous silk in the skin. Healing p. p. Highest temperature 100°. Patient lost track of.

Cases 8-9. Perfect result; last report (letter) December 1897, 5 years 7 months.

Surgical No. 1628. M. W., aet. 45; married, colored. Small, left inguinal hernia; strangulated, incomplete, acquired, indirect. Strangulation of 5 days' duration. Has had double inguinal herniae for 8 years. Operation 22-5-'92, Baltzell; ether. Sac contained omentum of good color and 100 cc. of a clear, straw-colored fluid. Sac was very adherent to the surrounding tissues and was excised and the neck closed with silk. Round ligament not found. Muscle not split. Fascia closed with buried silk and continuous silk in the skin. Healing p. p. Highest temperature 100.5°.

Surgical No. 1628. (Same case as above.) Operation 5-7-'92, Baltzell; ether. Right side. Similar operation. Healing p. p. Highest temperature 100.5°. November 1894, letter, 2 years 6 months, well, perfect result. December 1897, letter, 5 years 7 months, well, perfect result.

Case 10. Perfect result; last examination November 1894, 1 year 2 months.

Surgical No. 2396. M. C., aet. 21; married, colored. Small, left inguinal hernia; reducible, congenital. Operation 10-8-'93, Finney; ether. Sac small, excised, and neck closed with silk. Muscle split. Round ligament and veins ligated and excised. Muscle and fascia sutured with buried silk and continuous silk in the skin. Healing p. p. Highest temperature 99.5°. November 1894, 1 year and 2 months later, patient was operated on by Dr. Kelly for myoma. There was no recurrence of the hernia. Perfect result.

Case 11. Perfect result; last examination February 1897, 3 years 1 month. Examination made at autopsy after death, following operation; laparotomy for myoma of uterus.

Surgical No. 2543. C. D. M., aet. 44; single. Small, right inguinal hernia; reducible, incomplete, acquired, indirect, of 17 years' duration, following a strain on jumping from a carriage. Has worn a truss at intervals. Hernia gives a good deal of discomfort, but has not grown larger for a number of years. Operation 12-10-'93, Finney; ether. In front and about the sac was a mass of properitoneal fat, which was excised with the sac. The lumen of the small sac was obliterated. The peritoneal cavity was not opened. The round ligament was not found. Muscle not split. Wound closed with silk. Healing p. p. Highest temperature 100.8°. October 1894, 1 year, letter, perfect result. January 1897, letter, well, 3 years. February 1897, death following laparotomy for a myoma of the uterus; autopsy, hernia wound solid, perfect result.

Case 12. Perfect result; last report (letter) January 1899, 5 years.

Surgical No. 2700. J. M. S., aet. 27; single, student. Small, left inguinal hernia; reducible, incomplete, acquired, indirect, of 4 years' duration. Has

worn a truss, which has given some discomfort. Operation 16-12-'93, Halsted; ether. Sac very small, ligated and excised, without being opened. Muscle cut. Veins and round ligament ligated and excised. Wound irrigated with 1 to 1000 bichloride, and closed with silk. Healing p. p. Highest temperature 102°. 1 week after discharge from the hospital the patient returned with a small stitch abscess in the middle third of the wound, which was opened, and which healed all but a small sinus. 6 months later the sinus was excised and the wound irrigated and closed. Healing p. p. Highest temperature 99.5°. December 1896, 2 years, letter, perfect result. June 1897, letter, well, 2 years 6 months.

#### Case 13. Patient lost track of since operation.

Surgical No. 2860. L. C. W., aet. 20; single. Large, right inguinal hernia; reducible, complete, of 4 years' duration and slow formation. For the last 3 weeks it has been growing larger and has given a great deal of discomfort. Operation 13-3-'94, Halsted; ether. Sac large, wall thick. Contents, adherent omentum, which was excised. Muscle split. Veins and round ligament ligated and excised. Wound closed with buried silver in muscle and fascia and continuous silver in the skin. Healing p. p. Highest temperature 100°.

#### Case 14. Recurrence in the upper angle of the wound.

Surgical No. 2960. K. K., aet. 51; married. Large, left inguinal hernia; partly reducible, complete, acquired, indirect, of 12 years' duration and rapid formation, following lifting. Truss has been worn with great discomfort and is of little value. Operation 10-3-'94, Halsted; ether. Excision of sac and adherent omentum. Closure of neck with silk. Muscle split; round ligament not found. Wound closed with buried silver in the muscle and fascia and continuous silver in the skin. Subcutaneous fat was very thick. Muscle and fascia very thin. As the hernia had been very large and the ring large, a recurrence might be expected. Healing p. p. Highest temperature 101°. October 1894, 7 months later, examination: the patient states that she is perfectly relieved of her discomfort by the operation. The scar is 16 cm. long and 5 mm. wide. Below the middle third of the scar, on standing or coughing there is a slight bulging and impulse. May 1895, 1 year, there is a distinct hernia below the middle third of the scar, which seems to protrude through a split in the aponeurosis of the external oblique, and not through the scar tissue of the former operation. The opening is about 2½ cm. in diameter. (See Case 18, Surgical No. 4209, for second operation.)

#### Case 15. Patient lost track of since operation.

Surgical No. 3081. E. T., aet. 32; married. Small, left inguinal hernia; reducible, incomplete, acquired, indirect, of 10 days' duration, following a severe attack of coughing. The hernia gives a great deal of discomfort, especially when the patient is at stools. Operation 18-5-'94, Bloodgood; ether. Sac small, partly shut off by adhesions at the neck, excised and closed with silk. Muscle split. Round ligament not found. Muscle and fascia closed with buried silver wire and continuous silver wire in

the skin. Healing p. p. Highest temperature 100°. February 1897, lost, letter returned.

Case 16. Perfect result; last examination April 1895, 11 months; last report (letter) January 1897, 2 years 6 months.

Surgical No. 3125. M. M., æt. 9. Small, right inguinal hernia; reducible, incomplete, acquired, indirect. Operation 5-6-'94, Halsted. Sac very small, excised, neck closed with silk. Round ligament and veins ligated and excised. Muscle split. Muscle and fascia closed with buried silver wire and continuous silver wire in the skin. Healing p. p. Highest temperature 99.6°. January 1897, letter, well, 2 years 6 months.

Case 17. Perfect result; last report (letter) June 1897, 2 years 8 months. Wound suppurated.

Surgical No. 3613. B. S., æt. 18; single. Small, right inguinal hernia; reducible, incomplete, acquired, indirect, of 2½ years' duration, following traumatism. Has worn a truss. Operation 20-11-'94, Bloodgood; ether. Sac very small, ligated and excised, without being opened. Veins and round ligament ligated and excised. Muscle split. Wound irrigated with 1 to 1000 bichloride, and closed with silver wire. About the sac and between the pillars of the external ring and between the subcutaneous fat and apex of the external oblique, there was a great deal of new connective tissue. The wound suppurated and a small opening was made on the 15th day. Highest temperature had been 102°. No pain or discomfort had been complained of in the wound. On examining the wound on the 15th day, the skin was not injected or tender. The wound was slightly distended and fluctuating. The material filling the wound resembled liquefied blood-clot mixed with a great many fat globules. Microscopically no organisms could be found in the leucocytes, which were few in number, or in the fluid. Cultures showed but few colonies of the staph. pyog. albus and aureus. Patient was discharged in 6 weeks, the wound all healed but a small sinus. March 1897, 2 years 3 months, letter, well. November 1896, 2 years, well, perfect result. June 1897, letter, well, 2 years 8 months. Has been married and given birth to one child. Physician states that the hernia wound gave no discomfort during labor.

Case 18. Recurrence in the upper angle of the wound.

Surgical No. 4209. K. K., æt. 52. Left, inguinal hernia; recurrence after 8 months, operation 10-3-'94 (see Case No. 14). The swelling and impulse were noticed just above the outer half of the scar, and there is a distinct opening in the aponeurosis of the external oblique muscle at this point which measured about 2 cm. Operation 21-5-'95, Bloodgood; ether. The sac was covered by skin and subcutaneous fat. The opening into the peritoneal cavity measured about 3 cm. The recurrence seemed to have taken place through a split in the aponeurosis of the external oblique muscle, and was situated about 1 cm. above the position of the healed wound of the former operation. The sac was excised. In closing the wound the sutures did not include the peritoneum, but all the tissue

down to the peritoneum. This tissue consisted entirely of aponeurosis. No muscular tissue could be found. Wound healed p. p. Highest temperature 100°. 6 months later a second recurrence took place. This is situated between the lower halves of the 2 scars. It seems to be a split in the aponeurosis of the external oblique muscle. The opening measured about 2 cm. in length. This patient is about 52 years of age, and is very large and stout. The subcutaneous fat is very thick, the abdominal wall very relaxed, and the muscles very thin. Both wounds were closed with silver wire. It seemed that at both operations in closing the wound in the abdominal wall, a slight rent must have been made in the aponeurosis of the external oblique muscle, through which the recurrence took place. There was no evidence at the second operation that the recurrence was situated in the scar of the first operation, as no scar tissue nor silver wire could be found. Recurrence gives very little discomfort, and for this reason a third operation was not advised.

Cases 19-20. Perfect result; last report (by physician) September 1897, 1 year 3 months.

Surgical No. 5504. J. E. McC., aet. 26; single. Small, right and left inguinal herniæ; reducible, incomplete, of about 5 years' duration, following a fall, and very slow formation; associated with pains in the groin, extending down in the legs. Operation 10-6-'96, Finney; ether. Sac small, walls very thin, no adhesions. Round ligament and veins ligated and excised. Internal oblique muscle divided, and included in the sutured wound, which was closed with silver wire. Both wounds healed p. p. Highest temperature 100°. Cultures taken from the continuous subcutaneous silver wire in the skin, removed at the end of the 14th day, and from the skin under the silver foil, were negative. March 1897, letter, well, 9 months. September 1897, 1 year 3 months, letter from physician, perfect result.

Case 21. Perfect result; last report (by physician) August 1897, 1 year 2 months; last report (letter) November 1898, 2 years 5 months.

Surgical No. 5554. E. B., aet. 32; single. Small, right inguinal hernia; reducible, complete. 10 years ago the patient fell, and the fall was followed by soreness in the abdomen, which lasted about 2 weeks, and reappeared in about 6 months. At times she has had attacks of nausea and vomiting, and some headache, with difficult micturition. On examination there is a distinct bulging and impulse on the right side. The swelling is tender. She was not aware of the presence of the hernia. The patient is neurasthenic, and has had to give up work. Operation 18-6-'96, Bloodgood; ether. The sac appeared to be congenital, and contained a small mass of omentum, which was adherent through the entire length of the sac, and about the opening into the general peritoneal cavity. The sac and adherent omentum were excised. The round ligament and vessels were ligated and excised. The internal oblique muscle was divided, and was included in the buried sutures of silver wire in closing the abdominal

wound. In this operation the aponeurosis of the external oblique muscle and the internal oblique muscle was divided first. This made the dissection of the sac and its excision, with the adherent omentum, very easy. It was quite important in this case to completely free the omentum, and to reduce the stump, and to close the opening into the peritoneal cavity, in order to prevent further adhesions of the omentum, as there seemed to be no doubt that there was a distinct relation between this adherent omental hernia and the vague abdominal pains, associated with nausea. The wound healed p. p. Highest temperature 100°. The patient was discharged 4 weeks after operation, perfectly relieved of all her pains, although she had been in the hospital 5 weeks before the operation, under treatment for neurasthenia. February 1897, letter, well, 8 months. August 1897, 1 year 2 months, letter from physician, perfect result, gain in weight 21 lbs., no return of abdominal symptoms, general health excellent.

Case 22. Perfect result; last report (letter), physician, March 1899, 2 years and 9 months. Partial suppuration; secondary stitch abscess and sinus.

Surgical No. 5579. V. J., aet. 45; colored, washwoman. Very large, left inguinal hernia; strangulated, complete, acquired, indirect, of 21 years' duration. Very small until 9 years ago, when it gradually increased in size, after which a truss was worn. 36 hours before admission the hernia became irreducible and painful. 24 hours later nausea and vomiting began. Patient's general condition good. Operation 29-6-'96, Walker; ether. Under ether, before the sac was opened, the contents—probably intestine—became reduced. The sac was excised and closed with silk. The round ligaments and veins were ligated and excised. The internal oblique muscle was divided and transplanted. Wound closed with buried silver wire sutures. Wound was dressed at the end of the second week. It was found that one-half of the skin incision had not healed, but was separated by a small accumulation of pus; this portion, however, healed rapidly by granulation in 4 weeks. None of the deep sutures were exposed. Cultures from the wound staphylococcus aureus. Highest temperature 101°. August 1897, 1 year 2 months, letter, wound solid, but there is a stitch sinus which discharges and gives some discomfort.

Cases 23-24. Patient lost track of since operation.

Surgical No. 5850. M. W., aet. 19; colored, domestic. Medium, right inguinal hernia; reducible, complete; and reducible, left inguinal hernia, incomplete and congenital. Present since 2 years of age on the right side, and of only 4 years' duration on the left side. Truss gave so much discomfort that it has been discontinued. Operation 26-9-'96, Finney; ether. Both sides. On the right side the sac was excised and the round ligaments and veins ligated and excised. On the left side the sac, which was very small, was not opened, and the round ligament and vessels were not disturbed. The internal oblique muscles were not divided. The wound was closed with silver wire. Healing p. p. Highest temperature 102°, on the second day.

Cases 25-26. Perfect result; last examination September 1898, 1 year 9 months. Sac contained tube and ovary; typical operation.

Surgical No. 5968. L. K., æt. 38; single, domestic. Small, right and left inguinal herniæ; reducible, incomplete, congenital (?). The hernia on the left side has been noticed 10 years and followed heavy lifting. Has worn a truss off and on ever since. Hernia has gradually increased in size. Truss has always given some discomfort. The past year patient has suffered a great deal from pain in the groin and in the back. She had not noticed the small hernia on the right side. Operation 10-11-'96, Bloodgood; ether. Excision and suture of both sacs, ligation and excision of the round ligament, division of the internal oblique muscle. Both wounds closed with silver wire and catgut in the skin. Operator wore gloves. Sac on the left side extended down to the labia majora; its walls were thin and it contained the tube and ovary. The tube was adherent to the wall of the sac by a few fibrous adhesions, which were cut, allowing a reduction of the tube and ovary. There were two portions of the sac, one containing the tube and ovary, and a smaller portion, which contained 20 cc. of blood-stained serum, which under the microscope contained a few leucocytes, some few red-blood cells and a number of endothelial cells, many of which contained vacuoles. The sac on the right side was small and contained a small piece of omentum, which was adherent by its end to the apex of the sac. The adhesion was cut and ligated and the omentum reduced. Healing p. p. Highest temperature 100°. Examination March 1897, 4 months, perfect result. An interesting observation in this case was the pain in the left groin and back, on account of which the patient sought relief by operation. This is the second case in which the tube and ovary have been found in the sac. (See Case 2.) August 1897, examination, 9 months, perfect result. September 1898, examination, 1 year 10 months, perfect result.

Case 27. Perfect result; last report (letter) January 1899, 1 year and 10 months.

Surgical No. 6340. D. B., æt. 20; single, colored girl, housemaid. Small, right inguinal hernia; reducible, incomplete, acquired, indirect, of 3 years' duration, of slow formation. Attention was first called to a lump in the groin by the intense pain, and ever since its appearance patient has suffered more or less pain in the groin. Has never worn a truss. Examination: impulse and swelling were situated over the external ring and femoral ring, and on account of the thickness of the subcutaneous fat it was difficult to make out whether this was a femoral hernia, extending over and obliterating the external ring, or an inguinal hernia. Operation 11-3-'97, Bloodgood; ether. The femoral canal was first explored. It was found that there was no hernia present. Sac was found to come from the external ring; it was excised. The round ligament was not disturbed. The aponeuroses of the external oblique and the internal oblique muscle were divided and the wound closed with 4 sutures of silver wire, 3 of which included the divided internal oblique muscle. The conjoined

tendon was wide and firm. Healing absolutely p. p. Highest temperature 101°.

Case 28. Perfect result; last examination September 1897, 6 months. Last report (letter) November 1898, 1 year 9 months.

Surgical No. 6405. L. F., aet. 42; single, domestic. Small, right inguinal hernia; reducible, incomplete, acquired, indirect, of 14 months' duration, following heavy lifting. Hernia has been steadily increasing in size, and on account of this and the pain, patient sought operation. Operation 29-3-'97, Bloodgood; ether. Division of the aponeuroses of the external oblique and internal oblique muscle. Excision of the sac and a mass of peritoneal fat. Opening into the peritoneum closed with silk. Round ligament not disturbed. Wound closed with 4 sutures of silver wire, 3 of which included the divided internal oblique muscle and the 4th the conjoined tendon, which was wide and firm. Healing absolutely p. p. Highest temperature 100°. August 1897, 5 months, letter, perfect result. September 1897, 6 months, examination, wound solid.

Cases 29-30. Perfect result; last report (letter) October 1897, 6 months since operation; last report (letter) November 1898, 1 year 7 months. Round ligament transplanted on the left side.

Surgical No. 6470. J. E. W., aet. 18; single, domestic. Medium, right and left inguinal herniæ; reducible, acquired, indirect, incomplete. The hernia on the right side has been present since she was a baby, and on the left side it has been noticed for 3 years. Both herniæ have been slowly enlarging during the last year. She has attempted to wear a truss, but it has given discomfort and has not reduced the hernia. For the last 8 months the herniæ have incapacitated her for any heavy work; for this reason she sought operation. Operation 27-4-'97, Bloodgood; ether. On the right side the round ligament was excised. On the left side the round ligament was transplanted, similar to that in the operation on the male. On both sides the aponeuroses of the external oblique and internal oblique muscle were divided. On the right side the wound was closed with 4 sutures of silver wire, and on the left side with one suture above and 3 below the transplanted round ligament. On both sides the conjoined tendon was wide and firm and was included by the last suture; for this reason the external rings were not completely closed. On both sides the peritoneum of the sac extended half way around the round ligament and its vessels, making the dissection quite difficult, and the relation of the sac to that of the round ligament was different from that usually seen in acquired hernia. Operator wore gloves. Sac on the right side contained adherent omentum, which was reduced. The left sac was empty. Healing absolutely p. p. Highest temperature 101°. The incisions on both sides were at least 4 cm. from the spine of the pubes and were 8 cm. long. October 1897, 6 months, patient writes that she is well and is able to perform all her household duties.

Note.—This is the first case in which the round ligament has been transplanted. The procedure was a very simple one.

Case 31. Perfect result; last examination August 1897, 3 months. Indirect hernia; conjoined tendon obliterated; division and transplantation of rectus.

Surgical No. 6493. L. J., aet. 45; married. Medium, right inguinal hernia; reducible, incomplete, acquired, indirect, of 2 years' duration, following heavy lifting. Truss was worn for a year and a half, but has been discontinued for the last 6 months on account of discomfort and pain. Patient is a very stout woman, with a very pendulous abdomen. Operation 5-5-'97, Bloodgood; ether. The protrusion of the peritoneum was situated at the outer side of the deep epigastric vessels. It was so covered with thick, vascular properitoneal fat that it was not opened. The round ligament was not disturbed. The aponeuroses of the external and the internal oblique muscle were divided before the sac was exposed. It was then found that the conjoined tendon was obliterated and that one could pass almost the entire hand into the abdomen just above the pubes. As the divided internal oblique muscle can never be brought down as far as the pubes, it was considered advisable to attempt to transplant the rectus. The rectus muscle was cut across at right angles to its fibres, the division being a distance of 4 cm. above the pubes. The lower portion was twisted on its base and sutured to Poupart's ligament so that the divided internal oblique muscle and rectus muscle surfaces, as well as the aponeuroses, were approximated throughout the entire length of the abdominal wound. The cut in the rectus muscle was closed with 3 sutures of silver wire, making a Y-shaped wound. The subcutaneous fat was very thick. In passing the highest suture through the aponeurosis of the external oblique and internal oblique muscle, a vein in the muscle was injured. Operator wore gloves. Healing absolutely p. p. Highest temperature 99.5°. On the 20th day a small area of induration was noticed beneath the upper third of the incision; it seemed to fluctuate. On the 22d day 30 cc. of fluid blood were aspirated, and on the 24th day 25 cc. more of fluid blood. Patient left the hospital 10 days later. The area of induration had almost entirely disappeared. This small haematoma was, without doubt, caused by haemorrhage of the vein injured in passing one of the deep sutures mentioned in the operation. Cultures from the aspirated fluid negative.

Note.—This is the first case in which the rectus has been divided and transplanted in order to bring raw muscle surface against the lower third of Poupart's ligament in cases in which the conjoined tendon is obliterated.

August 1897, examination, 3 months, perfect result, no return of haematoma, induration has disappeared.

Case 32. Perfect result; letter August 1898, 1 year.

Surgical No. 6736. A. M., aet. 27; negro, housewife. Small, left inguinal hernia; irreducible, incomplete, acquired, indirect. The hernia has been present since birth. A truss has been worn with great irregularity for the last seven years. Six days before admission, while the patient was lifting a tub, the hernia became irreducible. There has been no nausea or vomiting. Bowels moved day before admission. The tumor

in the left inguinal region is about 4 x 3 cm in diameter; dull on percussion. The abdomen is soft and not distended; general condition excellent. Operation 10-7-'97. Cushing; ether; one hour after admission. Excision of the sac of the hernia and a hydrocele sac of the cord. Division of the internal oblique muscle. Wound closed with silver wire; conjoined tendon wide and firm and included by the last suture. After dividing the aponeurosis muscle a small hernial sac was opened and beyond this sac, adherent to the round ligament, was a small cyst, the wall of which was thick and the contents a yellowish brown fluid. Healing p. p. Highest temperature 101°. The round ligament and vessels were ligated and excision with the sac.

Case 33. Perfect result; June 1899, letter, well, 1 year and 11 months.

Surgical No. 6741. H. Y., aet. 22; negro, cook. Small, left inguinal hernia; reducible, incomplete, acquired, of nine months' duration. First noticed a small swelling of the groin after a hard day's work, washing clothes. Rupture has given no pain or inconvenience. For the last two months, however, the hernia has increased in size and has given a good deal of pain and discomfort when the patient walks, or is at work, and she has occasional attacks of abdominal colic. Operation 17-7-'97. Hoke; ether. Excision of the sac and round ligament. Division of the internal oblique muscle; wound closed with five mattress sutures of silver wire. Operator wore gloves. Healing p. p. Highest temperature 100°.

Cases 34-35. Perfect result; November 1898, last report (letter), 1 year and 3 months.

Surgical No. 6816. Mrs. P. H., aet. 30; housewife. Small, double inguinal hernia; reducible, incomplete, acquired, indirect. Hernia on the left side noticed five years. Hernia on the right side noticed three months. During the last year the hernia on the left side has given a good deal of discomfort, and during the last three weeks the patient has not been able to walk about much on account of pain in the left groin. Operation 11-8-'97, Finney; ether. Operation on both sides was similar. Closure of the sac after division of the aponeurosis of the external oblique. Closure of the wound with three mattress sutures of silver wire, the lower including the conjoined tendon. Internal oblique muscle was not divided nor was the cord disturbed in its position in the inguinal canal. Healing of both wounds p. p. Highest temperature 101°.

Case 36. Perfect result. Last report (letter), January 1899, 10 months.

Surgical No. 7508. J. P., aet. 14 years; schoolgirl. Small, right inguinal hernia; reducible, incomplete, indirect, acquired, of 2 months' duration, following heavy lifting, of slow formation. No truss worn. Operation 14-3-'98, Cushing; ether. Transplantation of round ligament and vessels. Division and transplantation of internal oblique muscle. Transplantation of rectus. Wound closed, silver wire. Conjoined tendon wide and firm. Contents sac, omentum, few adhesions cut, reduced. Healing per primam. No complications.

Case 37. Perfect result; June 1899, letter, well, 11 months.

Surgical No. 7848. K. G., aet. 6 years. Small, left inguinal hernia, reducible, incomplete, indirect (possibly congenital), noticed 5 days. Operation 1-7-'98, Bloodgood; ether. Round ligament excised. Internal oblique not divided. Wound closed, 1 silk and 2 catgut sutures. Catgut in aponeurosis of external oblique. Gloves worn. Conjoined tendon unusually wide and firm. Internal oblique muscle strong and wide. Contents of sac, omentum, not adherent. Healing per primam. No complications.

Case 38. Perfect result; June 1899, letter, well, 11 months.

Surgical No. 7885. L. B., aet. 10 years; colored girl. Small, left inguinal hernia; reducible, incomplete, indirect, apparently congenital, of 3 years' duration, 1 year after direct traumatism. Patient has suffered from pain for 1 week, which was the cause of her admission into the hospital. Examination: when the child stands and coughs one sees a small bulging at the external abdominal ring on the left side, careful examination otherwise negative. Operation 14-7-1898, Bloodgood; ether. (Group V.) Female cord excised, internal oblique muscle divided and transplanted, wound closed with 3 mattress sutures of silver wire, catgut to fix transplanted internal oblique muscle, continuous catgut in aponeurosis of external oblique, silver wire in skin, gloves worn, dressed with silver foil and gauze, plaster. Conjoined tendon wide and firm; internal oblique muscle wide and strong. The sac was opened before the internal oblique muscle was divided; projecting from the posterior wall of the sac was a spindle-shaped tumor extending the full length of the sac corresponding to the position of the round ligament, macroscopically it looked like ovary. To get a better view of its relation, the internal oblique muscle was divided and peritoneum above the neck of the sac; tumor was then found to extend from the fundus of the sac to the neck but not into the abdominal cavity. At the neck of sac it seemed continuous with the round ligament and vessels accompanying it. It seemed to have no connection with the uterus. The peritoneum was divided across above the neck of the sac and operator ligated what seemed to be round ligament and its vessels. The wound in the peritoneum was then closed with silk and the sac with this spindle-shaped tumor removed. Between the lower end of the sac extending through external ring into the subcutaneous tissue of mons veneris was a definite band tissue which was excised with the sac and the tumor. The wound healed per primam. No complications. The spindle-shaped tumor, which was covered by the peritoneum of the posterior wall of the sac, proved to be an ovary which had descended into the canal of Nuck, carrying with it a pouch of peritoneum.

Case 39. Sudden death 10th day. Thrombosis left internal iliac vein; embolus to the left pulmonary artery.

Surgical No. 8258. H. H. C., single, aet. 36 years. Small, left inguinal hernia; reducible, incomplete, acquired, indirect, 1 year 7 months' duration, following a fall. Truss worn but gave discomfort. Examination: Conjoined tendon wide and firm. Operation 25-10-'98, Bloodgood; ether. In-

ternal oblique muscle not divided; round ligament and vessels small, not disturbed. Wound closed with 3 mattress sutures, silver wire, after dislocating internal oblique muscle downwards and holding it in place with catgut. The sac had the anatomical relations to the round ligament of an acquired hernia. Triangle between the internal oblique muscle and the outer border of the conjoined tendon was small. Healing per primam. Convalescence uninterrupted until 2 A. M., November 4th (10th day). A four-hour temperature chart is on record. Highest temperature per rectum registered is 100.5° on the third day. Average pulse 80 to 90. For three days before the 4th of November the rectal temperature was 98° to 99.5°. At 8 A. M., November 3d, temperature was 100°. The first 4 or 5 days the patient suffered from abdominal distention. On the third day it was associated with nausea and vomiting and she passed an uncomfortable night; an enema was effectual. The special chart was discontinued on the 7th day, the patient not having suffered for two days from abdominal distention or constipation. Urine was acid, 1013, otherwise negative. Dr. Mitchell saw her at 9 A. M. on the evening of November 3d. At 2 A. M. on the morning of the 4th the patient was awakened out of a sleep with very severe pain in the calf of the left leg; she called on the nurse, who rubbed the leg for a few minutes. The nurse at this time noticed no other symptoms. She left the room for a few minutes to call the night superintendent, and on returning found the patient was cyanosed, and with respirations very slow and gasping, and that she was unconscious. When Drs. Cushing and Mitchell reached the ward, not more than 15 minutes later, the patient was cyanosed and had stopped breathing. She was perfectly unconscious. Pulse, however, could be felt in the wrist; it was of fair volume, not very rapid, pupils were equal. The patient made one or two gasps, attempting respiration just after Dr. Cushing entered the room. Artificial respiration was begun and continued for an hour; the pulse ceased about 10 minutes after artificial respiration was begun. Autopsy 1187, by Dr. Flexner. Anatomical diagnosis: thrombosis of left posterior iliac vein, embolism of left pulmonary artery, ecchymosis in the pleural membrane, myoma of uterus. Summary of autopsy: Body well nourished, no edema. Wound of the hernia operation, left side, healed per primam; no evidence of infection. The veins of the left lower extremity were exposed as far as the middle of the thigh. They were all patent and contained fluid blood. The posterior iliac vein on the left side contained a firm clot, the color was a greyish red and there were small whitish and greyish masses at right angles to the long axis, giving it an uneven, corrugated appearance to the thrombus. The vein for most of its length was involved; the adhesions to the vein wall were fairly firm. Small veins about the operation wound apparently were opened (there was no thrombosis of veins accompanying the round ligament), the appearance of the general peritoneal cavity was normal; both pleural cavities free, no adhesions of pleura. The lungs were pale, moderately collapsed; pericardiac cavity contained clear fluid, no excess. The right auricle was greatly distended with recent red clots, and the right ventricle contained some red clots. The left side of the heart was contracted and its cavities contained but very little blood. The cardiac valves all were delicate. In the descending branch of the right coronary artery there were several small, yellow patches of sclerosis, which, however, did not occlude the lumen. The heart's muscles were normal—weight

260 grams. In the tissues connecting the lungs with the vertebral column, one or two ecchymoses were seen—the largest, on the left side, is the size of a silver dollar. It is situated in the fibrous tissue covering at the edge of the lung and vertebral column. The main branch of the left pulmonary artery contains thrombosis, which entirely occludes this vessel; it presents characters similar to those in the thrombus found in the iliac posterior vein. From this thrombus (the embolus) recent red clots go over into the smaller arterial branches. In the branch of the pulmonary artery going to the right lower lobe a small clot, about the size of a cherry, occludes the vessel. In appearance it is the same as the clot just described and from it red clots extend into the finer branches. The lungs in general are pale, dry on section, no consolidation, kidneys normal, spleen normal, liver normal, a small myomata in the uterus. Tubes and ovary normal. Bacteriological cultures and coverslips from the thrombus in the iliac vein and embolus in the pulmonary artery, sterile. Cultures from the wound, a few colonies of staphylococcus pyogenes albus.

#### GROUP VI. McBURNEY'S OPERATION. 7 CASES.

##### Case 1. Perfect result; 4 years 6 months.

Surgical No. 97. M. E. L., girl, æt. 11. Small, right inguinal hernia; reducible, incomplete, acquired, indirect, of 4 years' duration and slow formation. Operation 9-9-'89, Brockway. McBurney's method. Out of bed in 4½ weeks. Discharged from the hospital, healed, in 9 weeks. Highest temperature 102°. 21-3-'92, 2 years and 7 months, examination, wound solid, scar soft, perfect result. 2-4-'94, 4 years and 6 months later, patient still well, no recurrence.

##### Case 2. Lost sight of.

Surgical No. 542. H. B., boy, æt. 8. Small, right inguinal hernia; reducible, incomplete, acquired, indirect, of 4 years' duration, following a fall. Has worn a truss, which had to be discontinued on account of pain and discomfort. Operation 17-7-'90, Brockway. McBurney's method. Discharged healed in 5 weeks. Patient lost track of.

##### Case 3. Perfect result; 3 years 8 months.

Surgical No. 543. H. D., boy, æt. 2½. Small, right inguinal hernia; reducible, complete, congenital, of 9 months' duration. Operation 17-7-'90, Brockway. McBurney's method. Discharged healed in 4 weeks. Highest temperature 100°. March 1894, 3 years and 8 months, examination, wound solid, no atrophy of testicle, perfect result. January 1897, lost.

##### Case 4. Recurrence.

Surgical No. 549. A. E., boy, æt. 5. Medium, right inguinal hernia; reducible, complete, acquired, indirect, of 4½ years' duration and slow formation. Operation 23-7-'90, Brockway. McBurney's method. Dis-

charged in 6 weeks, wound healed. The hernia returned in 3 months and was operated on again, according to the method of Dr. Halsted (see Group II, Case 2, Surgical No. 737). 3 years later, a letter states that there is no recurrence, no atrophy of testicle, perfect result. January 1897, letter, well.

#### Case 5. Recurrence.

Surgical No. 551a. G. W., laborer, æt. 45. Small, right inguinal hernia; reducible, incomplete, acquired, indirect, of 3 years' duration, following heavy lifting. Truss worn, which gives a good deal of pain. Operation 23-5-'90, Brockway. McBurney's method. Patient discharged in 6½ weeks, wound healed. 3 years later, examination, the scar has stretched. In the upper third of the scar, on standing or coughing, there is a distinct bulging, which gives very little discomfort. March 1897, 6 years 10 months, examination, no change, wears a truss with comfort, hernia small, reducible, incomplete.

#### Case 6. Perfect result; 4 years 4 months.

Surgical No. 562. K. F., girl, æt. 11. Small, right inguinal hernia; reducible, incomplete, acquired, indirect, of 5 years' duration. Truss worn until 1 month ago. Operation 4-8-'90, Brockway. McBurney's method. Discharged in 6 weeks, wound healed. April 1894, 3 years and 9 months, examination, wound solid, perfect result. April 1895, 4 years and 4 months, letter, still well.

#### Case 7. Recurrence.

Surgical No. 581. E. W., boy, æt. 5. Small, left inguinal hernia; reducible, complete, acquired, indirect, of 3 years' duration. Has worn a truss. Operation 11-8-'90, Brockway. McBurney's method. Discharged in 4½ weeks, wound healed. 3 months later, evidence of recurrence in the wound, since which time the patient has worn a truss. February 1894, 3 years and 5 months, patient writes that there is no recurrence of the hernia, but that he still wears a truss, which gives no discomfort.

### GROUP VII. TESTICLE PLACED IN THE ABDOMINAL CAVITY. 4 CASES.

#### Case 1. Perfect result.

Surgical No. 720S. A. P. W., æt. 41 years; hotel clerk. Very small, left inguinal hernia. Undescended testicle of 20 years' duration. Truss worn. Operation 15-12-'97, Cushing; ether. Replacement of undescended testicle in the abdominal cavity between the transversalis fascia and the peritoneum. Wound closed, silver wire. Internal oblique muscle weak, divided. Conjoined tendon obliterated. Transplantation of rectus. Sac not opened. Gloves worn. Healing per primam. Operation on right side (see Group II, Case 16). No complications. March 1898, 6 weeks, examination, perfect result, no pain complained of.

Case 2. Recurrence 3 months after operation, due to the descent of the testicle.

Surgical No. 7219. G. K., aet. 37 years; laborer. Large, left inguinal hernia; reducible, acquired, complete, indirect, of 2 years' duration, following strain, complete in 1 week. Truss worn. Operation 21-12-'97, Cushing; ether. Replacement of testicle within abdominal cavity. Wound closed, silver wire. Gloves. Internal oblique muscle good, divided, transplanted. Conjoined tendon wide and firm. Rectus not transplanted. Healing per primam. No complications followed operation. April 10, 1898, examination, patient states that he went to work two weeks ago, 3 months after operation. He is a stevedore and does very heavy lifting. On the evening of the third day his attention was called to the wound by heavy feeling, and he noticed a bulging which he could push back. It has given him no pain or discomfort. The bulging measures 3 x 2 x 2 cm. It is reducible. Feels hard, like the testicle, and has protruded from the abdominal wall between the outer border of the conjoined tendon and the internal oblique muscle, and out through the external ring in the aponeurosis of the external oblique. For second operation see Group I, Case 237, Surgical No. 7688.

Case 3. Perfect result; last report, examination, January 1899, 1 year.

Surgical No. 7289. H. K., aet. 17 years; laborer. Small, right inguinal hernia; reducible, incomplete, congenital, undescended testicle, present since birth. Testicle appeared at external ring 3 years. Frequent attacks of pain and swelling of testicle. No truss worn. Operation 12-1-'98, Cushing; ether. Replacement of undescended testicle in abdomen. Internal oblique muscle good, divided. Wound closed, silver wire. Conjoined tendon wide and firm. Gloves worn. Hernia interstitial 3d variety. Healing per primam. No complications.

Case 4. Recurrence, due to the descent of the testicle, 3 months after operation. Second operation.

Surgical No. 7196. J. S., aet. 53 years; baker. Small, recurrent hernia, in the lower angle of the wound, associated with the obliteration of the conjoined tendon. First operation 6 weeks ago (see Group II, Case 15, Surgical No. 7196). The operation was performed under cocaine, the hernia being strangulated. The wound healed per primam. Second operation 16-2-'98, Cushing; ether. Right side: (see Group I, Case 221, Surgical No. 7475). Left side: replacement of normal testicle in abdominal cavity, rectus muscle transplanted, wound closed with silver wire. Both wounds healed per primam. Examination, June 4, 1898, 3 months after second operation: on the left side there is a reducible mass (the testicle) which has pushed its way out into the abdominal cavity between the outer border of the rectus muscle and the internal oblique muscle. Third operation: (see Group IV, Case 26, Surgical No. 7770). Castration. Rectus muscle transplanted. Wound closed with silver wire, healing per primam. September 1, 1898, examination, 3 months: both wounds solid, right testicle normal, perfect result.

## GROUP VIII. BASSINI'S OPERATION. 2 CASES.

Case 1. Perfect result; letter September 1898, 4 months.

Surgical No. 7636. R. H. K., aet. 5 years. Medium, right inguinal hernia; reducible, complete, congenital, present since birth. Sac contained omentum slightly adherent with hydrocele sac. Operation 26-4-'98, Cushing; ether. Wound closed, silk. Gloves not worn. Veins not excised. Excision of sac. Omentum adhesions freed, reduced. No suture of sac over testicle. Silver wire in skin. Healing per primam.

Case 2. Perfect result; last report (letter) January 1899, 4 months.

Surgical No. 8102. J. C., aet. 65; colored, laborer. Small, right inguinal hernia, incomplete, acquired, indirect; symptoms of strangulation 10 hours, 4 years' duration. Also a much larger hernia on the right side of 15 years' duration. General condition excellent. Leucocytes not counted. Operation 11-9-'98, Cushing; cocaine, chloroform. Skin incision made under cocaine. Internal oblique muscle not divided. Sac opened; contents: loop of small intestine, circulation of which returned in a few moments after the constriction was divided; a few whiffs of chloroform administered; sac excised; opening into the peritoneal cavity closed with silk. Cord transplanted as in Bassini's operation. Wound closed with 3 mattress sutures below and 1 above the cord. The aponeurosis of the external oblique was sutured over the transplanted cord with interrupted sutures of fine black silk. Cord was very large, due to the veins. Gloves worn. Healing per primam. Convalescence uneventful.

## GROUP IX. VENTRAL AND UMBILICAL HERNIA. 22 CASES.

Case 1. Recurrence, 1 year; last examination May 1897, 4 years; last report (letter) December 1897, 4 years 7 months.

Surgical No. 2151. Mrs. J. J. T., aet. 60. Small, umbilical hernia; reducible, of 14 years' duration, following a strain. Operation 4-4-'93, Halsted; ether. Sac small, excised. Neck sutured with heavy black silk. The fascia was approximated with heavy white silk. The recti muscles were not exposed nor the umbilicus excised. Healing p. p. Highest temperature 99.5°. The hernia recurred in 1 year at the umbilicus. It is about one-third the size of the original hernia and gives very little discomfort. May 1897, examination, 4 years, recurrence no larger, wears a truss. December 1897, letter, 4 years 7 months, condition same.

Case 2. Perfect result; last examination September 1898, 5 years. Photograph Nos. 3 and 7.

Surgical No. 2331. C. A., male, aet. 21 months. Small, umbilical hernia, present since birth, reducible. Operation 9-23-'93, Finney; ether. Excision of the sac, approximation of the fascia with three mattress sutures of

heavy black silk. Closure of the skin with continuous subcutaneous suture of silk. Healing p. p. June 1897, examination, perfect result, 3 years 8 months (see Group I. Cases 57-58, operation for inguinal hernia). September 1898, examination, perfect result.

Case 3. Partial recurrence; last report (letter) November 1894, 8 months.

Surgical No. 2599. Mrs. F. K., aet. 32. Large, umbilical hernia; irreducible, of 11 years' duration, following the birth of her second child. Operation 3-11-'93, Halsted; ether. Excision of sac and a large mass of adherent omentum. The ring was about 4 cm. in length. In closing the wound, raw muscle surfaces were not made, but the peritoneal surfaces only were approximated. Buried sutures of silk, including the aponeurosis and the peritoneum. Healing p. p. Highest temperature 100°. November 1894, letter, 8 months, patient writes that there is a small bulging in the wound. May 1897, lost.

Case 4. Recurrence, 1 year; last examination April 1896, 1 year 10 months. Properitoneal ventral hernia.

Surgical No. 2766. T. S., male, colored, aet. 31. Small, ventral hernia, midway between the ensiform and umbilicus; irreducible, of 12 years' duration, following a kick in the abdomen. Associated for the last 6 years with attacks of abdominal pain and nausea, which occur sometimes once a week. Operation 23-6-'94, Halsted; ether. Excision of sac and a large mass of omentum. The wall of the sac was very thick. The opening in the linea alba, through which the omentum protruded, was but 1 cm. in diameter. The mass of omental fat measured 4 by 3 by 3 cm. The opening in the median line was enlarged to 3 cm. The wound was closed with mattress sutures of heavy white silk, which included the fascia only. No peritoneal suture was made. Skin closed with continuous silk. Healing p. p. Highest temperature 100.5°. 1 year later, a recurrence took place. It is reducible. The opening is about 1 cm. in diameter. It gives absolutely no discomfort. April 1896, examination, recurrence, no larger, 1 year 10 months.

Case 5. Perfect result; last examination September 1897, 3 years 4 months. Suture of recti muscles with silver wire, incision 20 cm. long.

Surgical No. 3068. B. T., aet. 36; female, married. Large, umbilical hernia; reducible. The skin about the umbilicus is the seat of a chronic eczema. Hernia of 5 years' duration, following 3 months after birth of the first child. Truss does not retain the hernia and gives much discomfort. Operation 17-5-'94, Halsted; ether. Excision of umbilicus and a large area of skin. Excision of the sac. Raw surfaces of the recti muscles were made. In closing the wound no peritoneal suture was made, but the wound was closed with mattress sutures of silver wire, approximating the raw surfaces of the recti muscles and the fascia. Skin closed with continuous silver wire. Healing p. p. Highest temperature

101.5°. December 1896, examination, 2 years 6 months, perfect result, scar 20 cm. long; patient gave birth to a child 10 months after leaving hospital. September 1897, examination, 3 years 4 months, perfect result, sutures not palpable, general health excellent.

Case 6. Patient lost track of since operation.

Surgical No. 3314. Mrs. D., aet. 38. Large, umbilical hernia; reducible, of 12 months' duration, associated with attacks of abdominal colic and nausea, followed by diarrhoea. Operation 14-3-'95, Halsted; ether. Sac large, ring 5 cm. in diameter. Excision of sac and a large mass of adherent omentum. Recti muscles not exposed. Wound closed with heavy white silk mattress sutures, passed through the fascia only. Continuous silver wire in skin.

Case 7. Perfect result; last report (letter) January 1897, 1 year 6 months.

Surgical No. 4188. Mrs. M. O., aet. 67. Very large, umbilical hernia; irreducible, of 20 years' duration. Has been irreducible for 6 years. Skin about the umbilicus, for an area of 6 by 5 cm., is ulcerated. This condition has been present for the last 18 months. The size of the hernia and the ulceration of the skin have made the life of the patient almost unbearable (see photograph). Operation 20-5-'95, Halsted; ether. The sac was very large and the wall very thick. About the umbilicus the intestines were adherent to the sac, and the sac to the skin, so that in dissecting the skin and sac from the intestines the peritoneal coat was torn. This occurred in 4 places. The area denuded measured about 1 by 1.5 cm. The denuded area was covered by intestinal sutures. A large mass of adherent omentum was excised. The sac and a large area of skin, including the ulcerated portion, were excised. The ring was 3 cm. in length. It was enlarged to 6 cm. during the operation. In closing the wound no peritoneal suture was made. The fascia only was approximated with mattress sutures of silver wire. The recti muscles were not found. The fascia, however, was strong and thick. During the operation it was, of course, impossible to prevent infection of the peritoneal cavity by the ulcerated skin, yet no bad result followed. Healing p. p. Highest temperature 100.5°. Cultures taken from the intestine over the denuded area, just after it had been dissected from the skin, showed a number of colonies of staph. pyog. aureus and albus, demonstrating conclusively that the peritoneal cavity must have been infected. Patient left the hospital in 4 weeks, perfectly relieved. January 1897, letter, 1 year 6 months, perfect result, photograph No. 16.

Case 8. Perfect result; last report (by physician) October 1897, 1 year and 11 months since operation.

Surgical No. 4878. Mrs. M. P., aet. 36. Small, umbilical hernia; partly reducible, of 4 years' duration, following the birth of her last child. For the last 6 months she has had attacks of pain in the right side of the abdomen, extending down to the right leg. Operation 17-12-'95, Bloodgood; ether. Excision of umbilicus, sac and a large mass of adherent

omentum. The opening of the sac measured 2 cm. The lumen of the sac 5 by 4 by 3 cm. The opening into the abdomen was enlarged from 2 to 8 cm. In closing the wound no peritoneal suture was made, but the fascia was approximated with mattress sutures of silver wire, 7 in number, and about 1 cm. apart. The recti muscles were widely separated and were not searched for, because the thickness of the fascia, which, when approximated, was considered quite sufficient to prevent recurrence. Healing p. p. Highest temperature 100°. No distention of the abdomen followed operation. May 1897, patient writes that she is well, the sciatica has not returned. October 1897, 1 year and 11 months, physician reports wound solid, patient 8 months pregnant.

Case 9. Perfect result; last examination June 1899, 3 years 6 months. Stitch abscess and sinus from silver wire.

Surgical No. 4923. Mrs. A. H., æt. 46. Small, umbilical hernia; partly irreducible, of 10 years' duration. Has had attacks of strangulation, associated with nausea. Operation 3-1-'96, Finney. Excision of umbilicus and sac. Excision of a large mass of adherent omentum. The opening into the abdomen measured 3 cm. It was enlarged to 8 cm. The sac measured 3 by 4 by 4 cm. In closing the wound no peritoneal suture was made, but the raw surfaces of the recti muscles and the fascia were approximated with 7 mattress sutures of silver wire. The recti muscles were not widely separated, so that they were approximated without difficulty. Wound irrigated with 1 to 1000 bichloride. Skin closed with buried silver wire. Entire wound healed p. p., except the formation of a small blood-clot, which was opened on the 16th day. The cavity was about 2 cm. deep and 1 cm. in width. It seemed to lead down to one of the deep sutures. Patient left the hospital in 5½ weeks, with a small discharging sinus. April 23, 1896, one month after her discharge, she was readmitted because of pain, tenderness and induration about the sinus extending upwards in the rectus muscle. Operation 23-4-'96, Bloodgood; ether. Excision of a sinus 3 cm. long, lined by granulation tissue, beyond which the wall was very fibrous. This sinus led to one of the buried silver wire sutures, which was removed. There was a distinct myositis of the right rectus muscle about the sinus. Wound was closed with continuous silver wire suture in the skin. Wound broke down on the 6th day and there was every evidence that the granulation tissue had not been completely removed at the first operation. 1-6-'96, second operation, Finney; ether. At this operation the entire rectus muscle was explored and it was found that leading from the position of the old and first sinus there was a second and deeper sinus, in which 3 silver wire sutures were found and removed. The entire wound was left open. The wound healed by granulation in about 6 weeks. December 12, 1896, examination, 9 months since the first operation and 6 months since the last, the scars are soft, the wound is solid. May 1897, examination, 1 year and 2 months since operation; there is no evidence whatever of recurrence. The patient has just been operated upon for gall-stones and is making a perfect recovery. At this operation the abdominal incision was examined from the peritoneal cavity and found to be solid; the omentum was adherent to the incision at one or two points. August 1898, examination, wound solid, perfect result, 2 years 8 months.

Case 10. Perfect result; last examination December 1896, 7 months; last report (letter) September 1897, 1 year 5 months.

Surgical No. 5291. R. P., aet. 43; married, housewife. Small umbilical hernia; irreducible, of 5 years' duration, following traumatism. Patient is very stout, with pendulous abdomen; weighs 207 pounds. Five years ago the patient struck her abdomen against the sharp edge of a piece of furniture, which caused a "sickening sensation," one week after which she noticed a small protrusion at the navel, which gradually increased in size up to its present diameter of 5 x 3 cm. During the past year it has been painful and she has had a number of attacks of nausea associated with incarceration of the hernia. In the last few months it has been irreducible. Operation 5-4-'96, Bloodgood; ether. Complete excision of the sac with its contents of adherent omentum and the umbilicus. Closure of the fascia with 6 sutures of silver wire. The recti muscles could not be found. The operation was performed in this manner: The skin and subcutaneous fat down to the aponeurosis were divided above and below the umbilicus, encircling the umbilicus to the right and left side and removing it with an area of skin about 1 cm., the sac was isolated from the subcutaneous fat, the rectus fascia was divided in the median line above and below the sac, and the peritoneum was opened above and below the sac; the sac was then found to contain adherent omentum, which, however, was not adherent to its neck; for this reason the neck of the sac was divided on the right side, and the sac with its adherent omentum was turned to the left; the omentum as it entered the sac was then ligated and the sac removed with its omental contents; this left an opening into the peritoneal cavity about 6 cm. in length, the edges of which consisted of peritoneum, a layer of very vascular propertitoneal fat, at least 1 cm. in thickness, and the cut edge of the fascia, which was 2 to 3 mm. in thickness. This opening was closed with 6 sutures of silver wire, which did not include the peritoneum. The fascia above and below this opening was then scarified for a distance of about 12 cm. and to the width of about 3 cm. 9 mattress sutures of silver wire were then placed in this fascia, the needle catching the fascia twice on each side of the median line, so that when the wires were drawn together and twisted this tissue was rolled upon itself and the first layer of silver sutures was inverted and covered by this second layer of sutures. The skin was closed with silver wire. Healing p. p. December 1896, examination, 7 months since operation: The scar is a narrow red line about 12 cm. long. Wound is absolutely solid. Patient says she suffers no discomfort whatever and is in excellent health and spirits. Silver wires are not palpable beneath the thick subcutaneous fat, and they have given no discomfort. Patient has had no attacks of abdominal colic or nausea since operation. September 1897, letter, 1 year 5 months, well.

Case 11. Perfect result; last examination July 1897, 2 months; last report (letter) September 1897, 4 months. Recti sutured with silver wire.

Surgical No. 6465. M. E., aet. 27; widow, housewife. Small, umbilical hernia; of 3 years' duration, which the patient attributes to muscular

strain. Has been irreducible for about 6 months; causes a good deal of pain and incapacitates her for work. Patient is very stout; has a pendulous abdomen; weighs 196 pounds. Operation 24-4-'97, Cushing; ether. Excision of the umbilicus and sac. Closure of raw surfaces, recti muscles and fascia with 8 sutures of silver wire. In this case the sac was empty, and after its excision, as the recti muscles were not too widely separated, their sheaths were divided on each side so that the operator was able to approximate not only the fascia, but broad raw surfaces of muscle. Healing absolutely p. p. Highest temperature 102°, for a few hours on the second day. Patient left the hospital in 4 weeks. Wound absolutely solid. Incision 9 cm. long. July 1897, examination, 2 months, perfect result. September 1897, letter, well, 4 months.

Case 12. Perfect result; last examination August 1897, 3 months; last report (letter) August 1898, 1 year 2 months. Pro-  
peritoneal ventral hernia.

Surgical No. 6513. H. C. S., aet. 47. Small ventral hernia, situated midway between the ensiform and the umbilicus. Irreducible, of 6 years' duration. Frequently painful to the touch and at times, when the tumor is tender, patient suffers from abdominal colic and nausea, which attacks have lasted several hours. Operation 14-5-'97, Finney; ether. Excision of a mass of properitoneal fat. Excision and suture of distinct sac. Closure of the divided fascia in the median line with 3 mattress sutures of silver wire. In this case the sheaths of the recti were not divided and the raw surfaces of muscle were not approximated. Healing p. p. Highest temperature 100.5°. August 1897, examination, 3 months, perfect result. August 1898, letter, well.

Case 13. Hernia in the right linea semilunaris. Lost track of since operation.

Surgical No. 6511. J. K., aet. 38; widow, housewife. Medium size hernia in the right linea semilunaris; reducible, acquired, of 3 years' duration, following labor. There is also a small, irreducible umbilical hernia. At the examination before the operation it was difficult to make out the origin of the hernia. The patient was very stout and the abdomen pendulous, weight about 200 pounds. The subcutaneous fat above the pubes was so thick that the external rings could not be palpated, but the position of the hernia was higher than that usually seen in inguinal hernia. The hernia was reducible, but the patient was so stout that it was impossible to feel the opening into the peritoneal cavity. The bulging measured about 4 x 3 cm. The upper outer border extended 1 cm. above a line drawn between the anterior iliac spine and the umbilicus. Operation 15-5-'97, Bloodgood; ether. Excision and suture of the sac. Closure of the wound with 10 sutures of silver wire, approximating raw surfaces of the internal oblique muscle to the sheath of the rectus. The sac in this case was not reached until the aponeurosis of the external oblique muscle was divided and the opening into the peritoneal cavity was found to be between the fascia of the linea semilunaris and the internal oblique muscle, the muscle being pushed outwards and downwards. The open-

ing into the peritoneal cavity measured  $4 \times 5$  cm. Below, it was bounded by strong internal oblique muscle, at least 3 cm. in diameter. The conjoined tendon was wide and firm. Above, it was bounded by the internal oblique muscle; to the outer side was internal oblique muscle; between it and the sheath of the rectus there was a centimeter of thick fascia. The sac was empty. After the excision and suture of the sac with silk, the internal oblique muscle was divided for a distance upwards and downwards about 3 cm., and that part of the muscle bounding the sac on the outer side was freshened. 10 mattress sutures of silver wire were then used; all the tissues except the peritoneum and broad raw muscle surfaces were approximated. The lower two sutures included the conjoined tendon, and the lower 7 sutures included the sheath of the rectus; the upper two sutures included divided external oblique muscle; all the sutures included the aponeurosis of the external oblique and internal oblique muscle. The aponeurosis of the external oblique was afterwards more carefully approximated with a continuous suture of catgut, and the skin was closed with silver wire. Healing absolutely p. p. Highest temperature 99°. The length of the skin incision was about 23 cm.

Note.—This is the first hernia situated in the linea semilunaris which has been operated upon in this hospital.

Case 14. Perfect result; last examination June 1, 1899, 3 years 10 months. Hernia following operation for appendicitis.

Surgical No. 4412. C. M., single, æt. 42; domestic. The operation for acute appendicitis took place two years ago. At this time the perforated appendix and a large mass of omentum were excised and the wound was closed with silk, with a large gauze drain extending into the abscess cavity. The closed portion of the wound above and below the gauze drain healed p. p. The sinus left by the drain healed by granulation in 6 weeks. Examination January 1894, 6 months after operation for appendicitis, no evidence of hernia. Three months later a small bulging and a slight impulse were noticed in the scar left by the sinus. This bulging gradually increased in size and extended down beneath the skin, almost to the pubes. It was always reducible. The opening into the peritoneal cavity measured about  $2 \times 3.5$  cm. at the end of two years. For 4 months before and after the appearance of the hernia the patient suffered with attacks of abdominal colic and nausea, associated sometimes with abdominal distention, which lasted two or three days. Examination July 12th, 1895: the opening is in the scar corresponding to the position of the gauze drain. The closed wound above and below is solid. The hernia is reducible. Operation 14-6-'95, Bloodgood. Excision of the sac and suture of the peritoneal opening with fine black silk. Dissection of free raw muscle surfaces of the internal oblique and external oblique muscles. Closure of the wound with 7 mattress sutures of silver wire and continuous silver wire in the skin. The sac of the hernia was immediately beneath the skin. Before opening the sac it was carefully dissected from the skin and the neck dissected from the surrounding scar tissue; also, before opening the sac, the scar tissue between the internal oblique muscle above and below the neck of the sac was excised and the internal oblique muscle isolated. In the upper portion of the wound the transversalis muscle and the external oblique muscle were also divided.

The opening into the peritoneal cavity measured 4 cm. In closing the wound the lower 3 sutures included the internal oblique muscle, the upper 3 sutures the internal oblique and transversalis and external oblique muscles. All the sutures included the aponeurosis of the external oblique. Skin closed with silver wire. Healing p. p. Highest temperature 100°. The patient has been examined at intervals of three to four months since operation. Last examination September 1898. 3 years: Scar is a fine white line. Wound is absolutely solid. The silver wires are palpable beneath the skin, but give no discomfort. Perfect result.

Note.—In this case it is very interesting to note that on opening the general peritoneal cavity not one adhesion could be found between the intestines and the parietal peritoneum or between the intestines. The position of the stump of the appendix, which was removed, could not be found. There was no evidence whatever that there had ever been a large abscess cavity surrounded by adherent intestines and omentum. This case demonstrates conclusively that peritoneal adhesions may completely disappear.

Case 15. Perfect result; last examination June 1899, 2 years 1 month. Hernia following operation for appendicitis.

Surgical No. 6545. E. L., female, æt. 21; single. Operation for appendicitis February 26, 1895, 2 years and 3 months ago. At this operation a large abscess was opened and drained. The appendix was not found. The general peritoneal cavity was opened into, but carefully packed off. The wound was closed with silver wire with a good deal of gauze packing into the abscess cavity. The closed wounds above and below the gauze healed p. p., except a slight superficial suppuration of the skin incision on the upper side. Patient was discharged in 5½ weeks, the wound having healed completely. Patient remained well and suffered no inconvenience from the wound until 3 or 4 months before her second admission, when she strained herself in carrying a heavy pail of water. At that time she noticed a severe pain in the region of the wound and said she experienced a sensation as if something had given way. In a few days she noticed a swelling in the scar. Three days before admission she had a severe attack of abdominal colic, associated with nausea and vomiting. Examination on admission: The scar measures 8 cm. long. The bulging occupies the middle third; it is about 3 x 2 cm. in diameter. The opening into the peritoneal cavity measures about 1.5 cm. The small hernia is reducible. Operation 20-5-'97, Bloodgood. The sac was situated just beneath the skin. It was excised with an area of scar tissue in the skin. Before opening the sac the neck was carefully dissected from the surrounding scar tissue. The hernia had protruded through an opening in the internal oblique muscle. After carefully isolating the sac down to the peritoneum the internal oblique muscle was divided above and below the sac for a distance of 4 cm. above and 5 cm. below, extending below to the linea semilunaris. The muscle which surrounded the neck of the sac was freed by dissection of the scar tissue, making fresh raw surfaces. After having thus freed the sac, excised the scar tissue, divided and isolated the abdominal muscle, the sac was opened into. The original opening measured 1½ cm. This was enlarged almost to the extent of the length of the division of the internal oblique muscle. Just above the

opening of the sac the cæcum was intimately adherent to the parietal peritoneum; covering the cæcum and adjacent small intestines was omentum, also adherent. The omental adhesions were freed and some of the omentum was excised in order to better expose the cæcum; the cæcum was then freed from the parietal peritoneum so that it would not be constricted when the wound was closed and would not interfere with the insertion of the sutures. After freeing the cæcum the stump of the old appendix was found. It was quite free, measured 2½ cm. in length, had a blunt end, a short vascular mesentery. The vessels of the mesentery were ligated, the appendix excised and the opening closed by suture of the cæcum over its invaginated stump. The lumen of the appendix was very much obliterated, but still admitted a probe about 1 to 2 millimeters in thickness. Closure of the wound, no suture of the peritoneum. Approximation of the internal oblique, transversalis and external oblique muscles and the aponeurosis of the external oblique muscle with one row of mattress sutures of silver wire, 10 in number. The aponeurosis of the external oblique was then more snugly approximated with a continuous suture of fine catgut. The skin wound was closed with silver wire. Healing absolutely p. p. Highest temperature 100°. Convalescence uneventful. No epigastric distention or colic. Patient left the hospital three weeks after operation. August 1897, examination, wound solid, no further attack of pain or nausea.

Note.—In this case all the adhesions had not been absorbed, the cæcum being very adherent to the parietal peritoneum and the omentum to the parietal peritoneum, cæcum and small intestines. The interval between the operation for appendicitis and that for hernia was 2 years and 3 months, about the same interval as that in Case 14, in which case, however, the adhesions had entirely disappeared. The amount of inflammation and local peritonitis with adhesions seemed to be about the same in both cases.

September 1898, examined, wound solid, perfect result.

Cases 16-17-18. In each case the original operation had been performed for extra-peritoneal rupture of the bladder. In these cases there had been three incisions, one in the median line for drainage of the bladder and one in each inguinal region for drainage of the space of Retzius. In each case, after removal of the gauze drain, the wound was allowed to heal by granulation, and there was no suture of the wound either after or before the operation. In Case 16 a hernia formed in the right incision only; in Cases 17 and 18, lateral incisions. In both cases the wounds in the median line, which also healed by granulation, but the upper part of which had been closed with two sutures of silver wire, approximating the rectus muscle, are solid.

Case 16, Surgical No. 6246. C. C., aet. 62; female. Operation for rupture of the bladder 20-5-'96. The wounds in the inguinal region healed by granulation in six weeks. The hernia appeared in the right lateral incision

seven months after operation. The bulging measured about 3 by 2 cm. The opening into the abdominal wall was about 1.5 cm. Hernia reducible; gives very little discomfort. The other two wounds are solid. Operation 8-2-'97, Bloodgood. Excision and suture of the sac with silk. Division of the internal oblique above and below the sac; division of the sheath of the rectus muscle, closure of the wound with 7 mattress sutures of silver wire, approximating raw surfaces of rectus muscle and internal oblique muscle, and also including the sheath of the rectus and the aponeurosis of the external oblique. Closure of the skin with continuous subcutaneous silver wire, interrupted catgut sutures in the aponeurosis of the external oblique. Length of muscle incision 8 cm., length of skin incision 10 cm. The sac was empty and there were no adhesions. Healing absolutely p. p. Highest temperature 100°. The sac was covered by skin and subcutaneous fat, the opening was through a split in the aponeurosis of the external oblique and the linea semilunaris. August 1898, examined, perfect result, 1 year 6 months. June 1899, well.

Cases 17-18, Surgical No. 6487. D. C., *aet.* 40 years. Patient was operated on for rupture of the bladder 4 months ago. The wounds in the inguinal region healed in 7 weeks; hernia appeared 10 weeks after. Examination April 1896: About the centre of the scars in each groin there is a reducible swelling; on the right side it measures about 4 by 3 cm., and the opening in the peritoneal cavity measures 2 cm. On the left side the swelling is smaller and the opening into the peritoneal cavity is about one cm. Opération 29-4-'97, Bloodgood. Excision and closure of the sac, suture of the internal oblique muscle and aponeurosis of the external oblique with silver wire; continuous catgut suture in the aponeurosis of the external oblique, silver wire in the skin. On both sides the hernia protruded through a small opening in the internal oblique muscle, surrounded by scar tissue and a split in the aponeurosis of the external oblique. The opening through the internal oblique muscle was about 2 cm. from the linea semilunaris. The sac was dissected and before opening the sac the aponeurosis was divided for a short distance above and below. The scar tissue about the neck of the sac was excised, leaving fresh-cut muscle surfaces of the internal oblique. On both sides the sacs were empty and there were no adhesions. Healing absolutely p. p. Highest temperature 101°. On the 15th day a small haematoma was noticed between the skin and the aponeurosis of the external oblique; in both wounds the fluid was aspirated, about 30 cc. on the right side and 20 on the left. Microscopically it consisted of red-blood cells and leucocytes, fat globules and fatty débris; no bacteria; cultures negative. Patient left the hospital in 4 weeks; both wounds solid. August 1897, 4 months, letter from his physician, perfect result. August 1898, 1 year 4 months, letter, perfect result. June 1899, well.

Case 19. Traumatic ventral hernia; August 1898, examination, 4 years 9 months.

Surgical No. 2619. J. K., *aet.* 29; brakeman. Rupture of the right rectus and right lateral abdominal muscles, with the immediate formation of a large hernia and symptoms of strangulation. The patient was admitted to the hospital one hour after the accident (at 10 A. M.), 9-11-'93. He had

been caught and crushed between the bumpers of two freight cars. On admission he was in a condition of collapse, pulse so rapid and feeble that it could scarcely be counted, sub-normal temperature, skin chilly and covered with perspiration. Both eyes were exophthalmic. Patient was conscious and complained a great deal of pain in the abdomen. To the right of the median line, just below the level of the umbilicus, there was a large swelling which was not reducible. It was tympanitic on percussion. The skin over the abdomen and over the back, the portion of the body which had been caught between the bumpers, showed no evidence of contusion. The patient was a very muscular man and probably when caught had held his muscles in an extreme degree of contraction. The contracted ends of the ruptured abdominal muscles could be felt beneath the skin, above and below the tumor. Patient was placed in bed and given some morphia hypodermically and salt solution by the rectum. The pulse slightly improved. Operation 7 P.M., 10 hours after admission, Bloodgood. After dividing the skin and the subcutaneous tissue, the intestines were found; they protruded through the ruptured abdominal wall, the right rectus was ruptured completely across, the three lateral abdominal muscles were ruptured outwards to the anterior axillary line. The ends of the ruptured muscles were almost as even and smooth as if they had been divided with a knife. There was no blood in the peritoneal cavity. There was no evidence that there had been haemorrhage from the lacerated tissues. Everywhere in the abdominal cavity, especially beneath the parietal peritoneum and in the mesentery and mesocolon, and beneath the parietal peritoneum over the kidneys, there was evidence of subserous extravasation of blood; the intestines themselves had only small areas of subserous haemorrhage. The peritoneum and muscular coat of the intestines in several places were lacerated, exposing the submucous coat; these were closed with mattress sutures of fine black silk, approximating the peritoneum; the intestines were then reduced and the wound in the muscle and peritoneum was partially closed with mattress sutures of heavy white silk. The skin was not closed. The remainder of the wound was packed with gauze. A complete suture of the lacerated muscle, especially the rectus, could not be made on account of the retraction of the muscles, and the critical condition of the patient prohibited any long operation. It was considered sufficient to suture the intestinal wounds, reduce the protruding intestines and close the abdominal wound by the most rapid possible method. Patient made an uninterrupted recovery. For three days after operation the pulse remained between 120 and 130. Highest temperature 102°, on the 6th day. The wound healed completely by granulation in about 8 weeks. The patient left the hospital in 10 weeks. A few weeks after his discharge from the hospital he was fitted with an abdominal support, which he has worn ever since with comfort. April 1895, one year six months, examination, well. November 1896, 3 years, examination, well, truss still worn. August 1898, 4 years 9 months, examination, area of bulging smaller, wears a light abdominal belt, works hard.

Case 20. Strangulated hernia. Death third day; pneumonia; anæsthetic, ether.

Surgical No. 7481. P. K., aet. 59 years; grocer. Small, ventral hernia. Epigastric, 35 years. Cough 1 week. Pain in rupture 4 days. Symptoms

of strangulation 24 hours. General condition not very good. Pulse 126. Bronchitis. Operation 4-3-'98, Halsted; ether. Incision 20 cm. long. Much properitoneal fat, which was excised. Sac contained piece of intestine and blood-stained fluid. Intestine much congested. Wound closed, 5 sutures silver wire, after exposing and including both recti muscles. Ether 1 hour. Healing per primam. Acute lobar pneumonia. Death 3d day. Right base chiefly involved. Temperature 105°.

Case 21. Perfect result; June 1899, examination, 18 months. Strangulated hernia; cocaine anaesthesia.

Surgical No. 7804. S. P., aet. 52 years; housework. Very large, umbilical hernia, 38 years' duration, irreducible many years. Symptoms of strangulation 4 days. Condition fair. Patient very fat, 250 lbs. Operation 16-6-'98, Bloodgood; cocaine. Reduction of ileum, cæcum and colon, and excision of adherent omentum. Wound closed, silver wire and silk. Gloves not worn. Condition after operation excellent. Incision 2 cm. long. There was no subcutaneous fat for a distance of about 6 cm. over the sac. The sac proper measured about 12 cm. longitudinally, the part adherent to the skin 6 cm. The opening into the peritoneal cavity 5 cm. From right to left 12 cm. The sac contained about 2½ to 3 feet of ileum not adherent; it was situated on the left side below the cæcum, colon descending and hepatic flexure. The large intestine was somewhat distended; this large intestine was adherent to the right side of the neck of the sac, but only adherent with interposing masses of fat which were easily separated. In the upper and right side of the sac was some omentum which was adherent to the large intestine and upper part of ring of sac. Operation in detail: Pulse 60, respiration 36. (The right had had  $\frac{1}{6}$  and  $\frac{1}{3}$  gr. morph. during day, the last at 1 P. M.)  $\frac{1}{8}$  gr. morph. (hypo.) Entire skin incision injected with 2½ oz. cocaine, 1 per cent., and 5 oz. of boiled water. Incision made without pain. Sac opened at once; it was found to contain omentum and large and small intestines. Ether given in order to aid reduction of intestines. Neck of sac enlarged on lower end 3 cm. Adhesion of large intestine ligated and divided, intestines reduced without difficulty. Omentum ligated, stump reduced, omentum and sac rapidly excised. Wound closed with heavy silver wire (6) and heavy white silk (3). Full time from skin incision to closure of deep wound 30 minutes. A few sutures of heavy white silk and some silver were used to reinforce the lower sutures. Skin closed, continuous subcutaneous suture of silver wire. A small bit of iodoform gauze was introduced into the centre of the wound to fill up the cavity which could not be completely approximated, rather than allow it to fill with blood-clot.

Case 22. Perfect result; January 1899, 4 months. Phlebitis of leg followed operation.

Surgical No. 8048. L. H., female, married, aet. 46; housewife. Medium, side ventral hernia, situated at the umbilicus, of 13 years' duration, during her fourth pregnancy, at which time she suffered from persistent nausea and vomiting. Hernia is reducible. Operation 30-8-'98, Finney;

ether. The sac contains a mass of adherent omentum, which was ligated and excised. Mass of adherent omentum was removed with the sac. Wound closed with 7 mattress sutures of silver wire, including the rectus muscle on each side. Gloves not worn. Healing per primam. On the tenth day patient began to complain of pain in the calf of the left leg, extending up into the groin. Highest temperature 102°, on the third day. With the appearance of the phlebitis of the left leg the temperature rose from 100° to 101° and remained between 100.5° to 101° for 4 days. Leucocytes not counted. Patient left the hospital in 24 days after operation. Leg was still swollen, giving some discomfort. Report January 14, 1899, wound solid, swelling of limb has almost disappeared.

#### GROUP X. FEMORAL HERNIA. 25 CASES.

Case 1. Perfect result; last report (letter) January 1897, 7 years 2 months.

Surgical No. 171. C. B., æt. 38; female, married. Small, left femoral hernia; reducible, of 6 years' duration, following heavy lifting. Operation 11-10-'89, Halsted; ether. Excision of the sac and suture of the neck with silk. Wound closed with silk. Healing p. p. Highest temperature 100°. November 1894, 5 years, letter, perfect result. January 1897, letter, well, 7 years 2 months.

Case 2. Patient lost track of since operation.

Surgical No. 261. S. McN., æt. 46 years; female, widow. Large, right femoral hernia; strangulated, small, reducible, femoral hernia on the left side. Strangulation of 3 days' duration, following an attack of diarrhoea. Operation 31-12-'89, Halsted; ether. Sac contained adherent omentum, which was excised. Omentum was quite dark in color, the circulation being almost checked. Sac was excised and the ring closed with heavy black silk. The wound was partly closed about a drain of iodoform gauze, extending down to the femoral ring. Patient was discharged in 5 weeks, the wound having healed solidly. Highest temperature 102°. February 1897, lost.

Case 3. Patient lost track of since operation.

Surgical No. 464. E. H., æt. 35; colored woman, married. Small, left femoral hernia. Strangulated 5 days. Hernia of 4 years' duration, following lifting and an attack of coughing. Operation 17-5-'90, Halsted. Sac contained a small quantity of clear, yellow fluid and a loop of the small intestine, which, although much congested, soon regained its circulation and was reduced. In order to reduce the intestine the neck of the sac had to be enlarged 2 cm. in an upward direction. It was closed with heavy black silk sutures. The skin wound was partly closed and a plug of iodoform gauze was packed down to the femoral ring. Patient discharged in 5 weeks, the wound having healed. Highest temperature 102°. Patient lost track of. March 1897, lost.

Case 4. Perfect result; last examination April 1894, 1 year 4 months.

Surgical No. 1977. C. M. S., æt. 50; male, married. Small, left femoral hernia; strangulated, of 18 hours' duration, following immediately after a strain at heavy lifting. One attempt at reduction just before admission into the hospital. Operation 25-2-'92, Parker; ether. Constriction (falsiform ligament) was divided. The sac contained a loop of intestine and 20 cc. of a blood-stained serum. The intestine was reduced, sac excised, and the neck closed with heavy black silk. The skin wound was closed with silk. Healing p. p. Highest temperature 100°. April 1894, 1 year and 4 months, examination, perfect result.

Case 5. Perfect result; last examination April 1895, 2 years; last report (by physician) December 1897, 4 years 9 months.

Surgical No. 2195. J. W., æt. 48; male, married. Small, left femoral hernia, of 4 years' duration, with 2 attacks of strangulation. Has worn a truss. Operation 25-4-'93, Halsted; ether. Excision of the sac and closure of the neck with heavy black silk. The skin closed with silk, with a small gauze plug, extending to the femoral ring. Gauze removed on the 12th day. Healing p. p. Highest temperature 101°. Patient discharged in 6 weeks. Has been examined and heard from frequently. Perfect result. Last examination April 1895, 2 years. December 1897, 4 years 9 months, letter from physician, perfect result.

Case 6. Perfect result; last examination October 1894, 1 year.

Surgical No. 2471. H. B., æt. 56; male. Small, left femoral hernia. Strangulated 48 hours. Hernia of 39 years' duration. Always reducible, making its appearance only at intervals. Operation 8-9-'93, Finney; ether. Sac contains a strangulated Littré hernia, which was reduced. The sac and a large mass of properitoneal fat excised. Neck closed with silk. Skin closed with silk. No gauze drain. Healing p. p. Highest temperature 100°. October 1894, 1 year, examination, patient does hard work, perfect result.

Case 7. Perfect result; last examination August 1898, 4 years 6 months.

Surgical No. 2871. P. D., æt. 63; male, married. Medium, right femoral hernia. Associated with enlarged glands in Scarpa's triangle. Hernia of 2 years' duration, reducible. Has worn a truss. Enlargement of the glands began 1 month ago. Operation 21-3-'94, Bloodgood; ether. Excision of a mass of glands in the groin (tubercular). Excision of a large mass of properitoneal fat or omental fat, whose connection with the peritoneal cavity had been obliterated. No definite sac could be demonstrated. The peritoneal cavity was not opened. The stump of the excised omental fat required 12 ligatures. Skin closed with silk. Wound irrigated with 1 to 1000 bichloride. The healing of the wound p. p. Highest temperature 99.2°. October 1894, 7 months, examination, perfect result. January 1897, examination, well, 2 years 10 months. October 1897, letter, well, 3 years 7 months. August 1898, examination, well.

Case 8. Perfect result; last examination June 1895, 1 year; last report (letter) July 1897, 3 years. Death, thermic fever.

Surgical No. 3165. A. U., æt. 42, male, married; driver. Small, left femoral hernia. Strangulated, 24 hours' duration. Hernia of 4 years' duration. Operation 14-6-'94, Bloodgood; ether. Sac contained intestine and omentum, the latter was excised. The intestine was reduced. Sac excised, neck closed with heavy black silk. Poupart's ligament sutured to the aponeurosis of the adductor muscles with silk. Wound closed with silver wire. No gauze packing. Healing p. p. Highest temperature 101°. June 1895, 1 year, examination, perfect result. February 1897, letter, well, 2 years 6 months. July 1897, 3 years, death, thermic fever in hospital, no recurrence of hernia.

Case 9. Death on the 10th day from acute infection of right hydronephrosis; hernia strangulated.

Surgical No. 3176. Female, æt. 34. Small, right femoral hernia. Symptoms of strangulation 3 days. Hernia 10 years' duration. Until this attack always reducible. For a number of years the patient has noticed a tumor in the right lumbar region extending into the right umbilical region. The tumor had the appearance of right hydronephrosis. No history of attacks of pain, chills or fever. The hernia became irreducible 3 days ago and was associated with vomiting, which has been continuous. The patient also suffered from severe pains in the abdomen. There was complete constipation. At the end of 24 hours, under chloroform, taxis had been attempted, but failed. Passed no flatus. On admission to the hospital, the patient was in good condition, suffering very little from pain, was not vomiting. The abdomen was slightly distended and tympanitic but not tender. There was a tumor occupying the right lumbar region, extending into the right umbilical region. Considered to be enlarged right kidney. Operation 20-6-'94, Bloodgood; ether. Excision of the sac and mass of omentum. Closure of opening of the peritoneum with silk. Skin wound closed with silver wire. The mass of omentum which was strangulated was small, requiring but one ligature; its circulation was good. At the autopsy this ligature was found on the transverse colon and the piece of omentum which was found in the sac was no doubt one of the epiploica adiposa. Patient exhibited all the symptoms of strangulation of a piece of the intestine. Following the operation the patient had no rise of temperature and was perfectly comfortable until the evening of the 9th day, when she complained of a chill. Rectal temperature taken immediately after chill registered 105° (F.), at the same time she complained of pain over the tumor in the right side of the abdomen. The tumor was noticed to have increased in size and was very tender. Next morning (12 hours later), high temperature still being present, the increase in size of, and the tenderness over, the tumor still persisting and the general condition of the patient being worse, it was considered best to drain the kidney at once. Under ether, an incision was made in the lumbar region, and a large hydronephrotic right kidney found. The pelvis was opened and drained. It contained about 200 cc. of a pale, cloudy fluid, specific gravity 1002. Coverslips made from this fluid showed numerous leucocytes and a number of short bacilli. Cultures carefully

studied demonstrated that the bacilli were the *lactus aerogenes* in pure cultures. Death took place 10 hours after the 2d operation. Rectal temperature 107.5° (F.). Eight hours after operation for hernia 500 cc. of urine were drawn from the bladder by a catheter. In the next 24 hours the patient voided 650 cc. of urine; in the next 24 hours 590 cc. of urine. As the patient was making an uninterrupted convalescence there was no record of urine after the third day following the hernia operation until the chill and rise of temperature on the 8th day, when she again had to be catheterized. In the 24 hours before the 2d operation 910 cc. of urine were withdrawn by the catheter, demonstrating that there was no suppression of urine. Eight hours after the 2d operation, the bladder was catheterized and contained but 35 cc. of urine; 8 hours later the bladder was catheterized again and not a drop of urine could be withdrawn. This demonstrates that following the 2d operation there was *anuria*. Autopsy No. 538, by Dr. Welsh: Very large hydronephrosis, with abnormal opening of the right ureter into the upper end of the renal pelvis. No wound or peritoneal affection. Emphysema and pulmonary oedema, fatty heart, liver and kidneys; chronic, diffuse nephritis of the left kidney and also of the little portion of the right kidney which was present. Practically no urine in the bladder. No dilation of the ureters, no evidence of cystitis and no infection of the left kidney. Cultures and coverslips made at the autopsy from the right kidney demonstrated the same bacillus found in the pelvis of kidney at the second operation. Cultures from the blood negative.

Case 10. Perfect result; last examination July 1895, 3 months; last report (letter) February 1897, 1 year 9 months.

Surgical No. 4177. M. V. G., aet. 49; female, married. Large, right femoral hernia; irreducible, of 20 years' duration. Until a few months ago was only about 3 cm. in diameter. It is now 8 cm. The tumor feels cystic and gives discomfort only from its size. Operation 6-5-'95, Bloodgood; ether. The sac was large, the ring very small, 5 mm. in diameter. Contents, a clear yellow fluid, which was not reducible before operation. The sac was excised with a large mass of properitoneal fat. The neck closed with heavy black silk. Skin closed with a small gauze drain, extending to the stump of the closed sac. The gauze was removed on the 10th day. The wound healed p. p. Patient was discharged in 4 weeks, wound healed. Examination 3 months later, no recurrence. February 1897, 1 year 9 months, letter, well.

Case 11. Perfect result; last examination August 1895, 2 months; last report (letter) March 1897, 1 year 8 months.

Surgical No. 4284. K. C., aet. 50; female, widow. Small, right femoral hernia. Strangulated, of 3 days' duration. Attempts at reduction have failed. Hernia of 1 month's duration, began with pain in the groin, associated with nausea and vomiting, which lasted 6 hours. Operation 3-6-'95, Bloodgood; ether. The sac contained a small loop of intestine, which was returned before the sac was opened, just after the constriction had been severed. Excision of sac and a large mass of properitoneal fat, containing a number of enlarged glands. Neck of sac closed with heavy

black silk. Wound irrigated with 1 to 1000 bichloride. Skin closed with silver wire. A small gauze drain introduced to the stump of the sutured sac. Healing p. p. Gauze drain removed on the 12th day. Highest temperature 100.5°. Patient discharged in 5 weeks, the gauze sinus having healed solidly. August 1, 2 months, examination, perfect result. March 1897, 1 year 8 months, letter, well.

Case 12. Perfect result; last examination January 1897, 1 year.

Surgical No. 4967. F. S., æt. 46; cabinetmaker. Medium, right femoral hernia; strangulated (3 days). Has had a small, reducible, femoral hernia for 12 years, which has given no discomfort until 3 days ago, when it became irreducible. On admission the patient was in excellent condition, there had been no nausea or vomiting. Operation 26-12-95, Bloodgood; ether. The sac contained 50 cc. of a blood-stained fluid and a mass of omentum about 4 by 3 by 3 cm., which was black in color, the circulation being completely checked. Constriction was at the femoral ring. The stump of the omentum measured here about 8 mm. and required 10 ligatures. In order to reach the neck of the sac Poupart's ligament was incised upwards for 1 cm. The neck was closed with heavy black silk. Poupart's ligament was sutured with silk and the fascia of the adductor muscles was sutured over the neck of the sac to Poupart's ligament. Wound irrigated with 1 to 1000 bichloride and closed with buried mattress sutures of silver wire and subcutaneous continuous wire in skin. Healing p. p. Highest temperature 100°. January 1897, 1 year, examination, well.

Case 13. Perfect result; last examination August 1898, 2 years 6 months.

Surgical No. 5140. Mrs. A. F., widow, æt. 54; housekeeper. Very large, right femoral hernia, strangulated. Hernia of 28 years' duration and has very gradually grown to its present large size. During the last two years patient has had a number of attacks in which the rupture has become irreducible. A truss was worn until 3 years ago, but discontinued because it would not retain the hernia. Symptoms of strangulation 6 hours. Examination: Occupying the right groin, extending from the spine of the pubes out to the anterior iliac spine and above and below Poupart's ligament for a distance of 4 cm., was a large tense tumor, which in some places was dull on percussion and slightly tympanitic. Operation 19-2-96, Bloodgood; ether. Excision of the sac. Closure of the opening into the peritoneal cavity with silk. Closure of the skin wound with silver wire. Before dividing the constriction the sac was opened into; it contained blood-stained serum, a small mass of omentum and a small loop of intestine, which was slightly congested. The chief contents of the sac was fluid. The constriction was divided and the omentum and intestine reduced. The sac was then divided across 2 cm. from its neck and the opening into the peritoneal cavity closed at once with silk. The remainder of the sac, which measured at least 15 x 16 cm., was very easily and quickly removed from above downwards, chiefly by tearing. Very few vessels were injured. This immense sac extended upwards on the aponeurosis of the external oblique for 4 cm., and outwards within 2 cm.

of the anterior iliac spine, and downwards almost to the junction of the middle and lower third of the thigh. Healing absolutely p. p. Highest temperature 99°. February 26, 1897, examination, wound absolutely solid; suffers from no pain or discomfort and has been completely relieved of the great discomfort which the rupture had given her. August 1897, examination, 1 year 6 months, perfect result.

Case 14. Perfect result; last examination August 1898, 1 year.

Surgical No. 5712. Mrs. F. R., aet. 44; housewife. Medium, irreducible femoral hernia, of 5 years' duration, following heavy lifting. Became irreducible about 2 weeks ago. Operation 10-8-'96, Finney; ether. Excision of the sac with its contents of adherent omentum. After excision and suture of the sac, the fasciae about the femoral canal were closed with 4 mattress sutures of silver wire, which included the edge of Poupart's ligament. Skin wound was closed with silver wire. Healing p. p. Highest temperature 99°. May 22, 1897, examination, 9 months, wound solid, perfect result. August 1898, letter, well, 2 years.

Case 15. Perfect result; last examination February 1897, 3 months; last report (letter) September 1897, 9 months.

Surgical No. 6054. J. G., aet. 28. Small, right femoral hernia; strangulated 6 hours. Hernia of 2 years' duration. No history of strain or injury. Operation 27-11-'96, Finney; ether. Excision and suture of the sac, approximation of the fascia to Poupart's ligament with silver wire. Skin closed with silver wire. Operator wore gloves. In this case the constriction was divided before the sac was opened. The moment the constriction was divided the contents of the sac, whatever they may have been, immediately returned into the abdomen, so that when the sac was opened it was impossible to ascertain the condition of the strangulated intestine. This case demonstrates that in strangulated femoral hernia one should open the sac before dividing the constriction. The sac in this case measured 3 x 3 cm. There was no evidence of exudate, but beneath the peritoneal surface, especially about the neck of the sac, were small areas of haemorrhage. In dividing the constriction of the sac, Poupart's ligament was divided for a distance of about 1 cm. This was included in the buried silver wire sutures. Healing absolutely p. p. Highest temperature 100°. February 25, 1897, 3 months, examination, wound solid, perfect result. September 1897, letter, 9 months, well.

Case 16. Perfect result; last examination August 1897, 7 months.

Surgical No. 6191. R. J. R., male, aet. 26. Small, left femoral hernia; reducible, of 10 years' duration. No history of strain or injury. Has given discomfort during the last year and the patient has attempted to wear a truss, which, however, was of little value. Operation 18-1-'97, Walker; ether. Excision of the sac with a small mass of omentum, which was not adherent, and also a mass of properitoneal fat. The skin wound was closed with silver wire, leaving a small gauze drain extending down to the sutured sac (Dr. Halsted's method). Healing absolutely p. p., except

the sinus left by the gauze drain, which healed in two weeks. August 1897, examination, 7 months, perfect result.

Case 17. Perfect result; last examination December 1897, 10 months.

Surgical No. 6230. Miss M. R., æt. 26; dressmaker, single. Small, right femoral hernia; reducible, of 2 years' duration, following a strain. Shortly after the appearance of the hernia a truss was worn, but was discontinued because it did not retain the hernia and gave very much discomfort. Operation 5-2-'97, Finney; ether. Excision and suture of the sac. Approximation of the fascia to Poupart's ligament with silver wire. Closure of the skin with silver wire. Operator wore gloves. The sac contained a small tag of omentum, which was adherent to the neck of the sac by one narrow band. This band was divided and the omentum reduced. Healing absolutely p. p. Highest temperature 100°. December 13, 1897, examination, 10 months, perfect result, wound solid, external ring closed.

Case 18. Perfect result; last examination August 1898, 1 year 3 months.

Surgical No. 6572. L. K., æt. 64; German. For notes on operation for the femoral hernia, see Group IV, Case 20.

Case 19. Perfect result; letter December 1897, 5 months.

Surgical No. 6805. Mrs. A. J. B., æt. 42. Small, right femoral hernia; reducible, of two and a half months' duration. Has given no discomfort or pain; has not worn a truss. Patient desires operation rather than wear a truss. Operation 5-8-'97, Cushing; ether. Excision of a small sac and a large mass of properitoneal fat. Closure of the opening into the peritoneal cavity with silk; no attempt was made to suture the tissues over the femoral opening. Skin wound closed with silver wire. The tumor in the groin consisted of a small sac surrounded by a much larger mass of fat-containing vessels. Sac was empty. Healing absolutely p. p. Patient remained in bed on her back for 21 days. Highest temperature 100°.

Case 20. Death 2 months after operation. Sarcoma of omentum.

Surgical No. 6944. Mrs. A. M., æt. 46; large, right femoral hernia; irreducible. Hernia first noticed six years ago. It was then about the size of a walnut and has gradually increased in size. For the first five years patient wore a truss, which, however, did not seem to hold the hernia in place and frequently the hernia came down behind the truss. The truss gave a good deal of discomfort and caused a good deal of irritation, but the patient persisted in wearing it for five years. During the last four years the patient has had occasional attacks of nausea and vomiting when the tumor would become larger. For seven months the tumor has been irreducible and has been increasing quite rapidly in size. During

these seven months the attacks of nausea and vomiting have been more frequent and the patient thinks that she has lost flesh and there has been a decided depression in her general health. About three months ago she noticed small nodules in both breasts. Operation 23-9-'97, Young; ether. On opening the sac of the hernia it contained fluid and adherent omentum. In the centre of the omentum there was one large nodule. On drawing the omentum out through the femoral canal it was found to be infiltrated in every direction with these nodules of various sizes. On section (macroscopically) the nodules in the omentum were evidently sarcoma, and as the omentum was everywhere infiltrated a complete excision would have been impossible. For this reason only a part of the omentum was removed, and as there was bleeding the wound was closed with gauze packing down to the stump through the femoral canal. The wound healed by granulation in about four weeks. November 1, 1897, the patient is still in the hospital, six weeks after operation. Wound has healed and is solid. Her general health remains about the same. On palpation no nodules can be made out in the abdomen. The liver and spleen are not enlarged. The nodules present in the breasts have not increased much in size. Microscopical examination of the nodule removed from the omentum proved the new growth to be a round-celled sarcoma. November 30, 1897, death.

Case 21. Perfect result; last report (letter) January 1899, 1 year and 1 month.

Surgical No. 7187. Mrs. M. M., aet. 58. Medium, left femoral hernia, of 16 years' duration. Previous to this attack, two years ago, the hernia became irreducible with symptoms of strangulation. Present attack of 26 hours' duration. General condition excellent. Operation at once, 2-12-'97, Finney; ether. In front of sac there was a large mass of fat; sac contained a small knuckle of intestine, very much congested, which was reduced; wound closed with silver wire; healing per primam. Convalescence uneventful.

Case 22. Perfect result; November 1898, letter, 9 months.

Surgical No. 7423. S. M. H., aet. 48 years. Small, left femoral hernia. Reducible, of 12 years' duration. Six years ago a right femoral hernia appeared and soon became strangulated. An operation was performed. The result is a perfect one. Haemorrhoids 22 years. Operation 17-2-'98, Halsted; ether. Excision of sac. Closure of wound, gauze drain. Sac contents adherent omentum. Adhesions cut, reduced. Complete excision of haemorrhoids. Healing per primam. Gauze removed 10th day. Catheterization 5 days.

Case 23. Perfect result. Lost track of.

Surgical No. 7486. A. H., aet. 35 years; nurse. Small, right femoral hernia; reducible 2 months, following a strain, of rapid formation. Has given much pain and discomfort. Operation 11-3-'98, Finney; ether. Excision of sac. Wound closed with plastic on adductor longus muscle, first case. Healing per primam. Lost track of since operation.

Case 24. Perfect result; November 1898, letter, 8 months.

Surgical No. 7544. L. F. B., aet. 41 years. Small, right femoral hernia; reducible, of 2 years' duration, following traumatism, of immediate formation. Several attacks of irreducibility with nausea and vomiting. Truss not worn. Operation 25-3-'98, Finney; ether. Femoral hernia. Excision of sac. Wound closed, silver wire with plastic on adductor longus muscle, second case. Healing per primam. No complications.

Case 25. Perfect result; January 1899, report, 7 months. Cocaine.

Surgical No. 7777. M. S., aet. 50 years; housewife. Medium, right femoral hernia of 6 years' duration. No truss. Irreducible, with symptoms of strangulation 5 days. Condition on admission not good. Operation 8-6-'98, Bloodgood; cocaine and chloroform. Incision of sac. Division of constriction outside of sac. Reduction of a knuckle of very congested intestine. Excision of adherent omentum and sac. Opening into peritoneal cavity closed with silk. Divided Poupart's ligament closed with silk. Wound closed, silver wire. No drainage. Healing per primam. Wire removed 10th day by Dr. Packard at patient's home. No complications. Operation: Morphia  $\frac{1}{8}$  gr. (hypo.). Cocaine, 1 per cent., 23. Boiled water 4 3. Skin incision made exposing Poupart's ligament and sac. No pain. Division of Poupart's ligament over femoral opening. Some pain complained of. Patient struggled, for this reason a few whiffs of chloroform were given and continued for 15 minutes. Division of ligament inguinale. Division of a third constricting band, probably the ligamentum inguinale lateralis internus. After the division of this last ligament the sac was exposed and there was no further constriction. Before dividing this last constriction the sac was opened. It contained adherent omentum, a little clear fluid and a small knuckle of small intestine. After the division of the constriction the small knuckle of intestine was drawn out for inspection. It was dark in color, walls firm, mesenteric vessels not thrombosed. The omentum was very much congested and thrombosed. It was drawn out, ligated and the stump reduced. The intestine was then reduced. There was a good deal of clear yellow fluid in the abdominal cavity. Sac cut across. Peritoneum sutured, silk. Omentum and sac removed from above downwards in one piece. Poupart's ligament and ligament inguinale sutured with silk, tightly closing the opening into the abdominal cavity. Skin wound closed, silver. Dressed foil. Leg flexed. Full time of operation 45 minutes. Patient suffered practically no pain.

#### GROUP XI. STRANGULATED HERNIA, INTESTINE GANGRENOUS, OR A GENERAL PERITONITIS PRESENT BEFORE OPERATION. 11 CASES.

Case 1. Inguinal hernia; resection; artificial anus; secondary resection and suture on the 12th day. Death, peritonitis.

Surgical No. 868. B. B., aet. 41. Large, right inguinal hernia; strangulated 5 days. Patient states that he had not noticed the rupture until the

day on which the swelling appeared in the right groin. This swelling could not be reduced. In a few hours after its appearance he began to vomit and hiccup. His physician made attempts at reduction on the 3d, 4th and 5th days and also gave cathartics. On admission the temperature was 99.2° (F.). Pulse 64, of good character. Vomiting was frequent; material contained bile. Hiccoughs at irregular intervals. The tense mass in the right groin did not descend into the scrotum. Operation 20-2-'91, Halsted. Incision of the sac. Resection of 110 cm. of gangrenous intestine. Artificial anus. The excised intestine was very much distended. The sac and the general peritoneal cavity contained a large amount of blood-stained serum. Of the 110 cm. of gangrenous gut, not more than one-third was situated in the sac; the remainder was in the general peritoneal cavity, although the constriction of the intestine was situated at the neck of the sac. The extent of the gangrene was most likely due to the thrombosis of the mesenteric vessels. An end-to-end suture was not performed because the condition of the patient was not good and the circulation of the ends of the resected gut was poor. The two resected ends were brought out of the wound and held in place by gauze. The patient made a good recovery from the operation. Highest temperature 101°. Pulse 90 to 100. The skin, however, about the wound became the seat of a very acute dermatitis. Second operation 3-4-'91, Halsted (12th day). Resection of about 30 cm. of intestine; end-to-end suture. The operation was a very difficult one on account of the intestine, the circulation of which was very poor. There had also been a perforation of the intestine and the formation of an abscess in the abdominal wound. The sutured ends were replaced in the abdominal cavity and gauze packing was arranged about the sutured gut and into the abscess cavity. Patient died in 36 hours. Autopsy 176: Acute peritonitis; acute and chronic endocarditis. Chronic passive congestion of the lungs.

Case 2. Resection and immediate end-to-end suture; inguinal hernia. Death, peritonitis.

Surgical No. 4990. Z. M., æt. 23; laborer. Medium, right inguinal hernia; strangulated 48 hours. Complete, acquired, indirect. Patient gave the following history: That he had noticed during the last 12 years, two or three times a year, a small mass in the right groin, which was easily reducible. He also stated that 12 hours before admission to the hospital something came down into the scrotum and that the swelling of the scrotum has rapidly increased in size since then. There was no nausea or vomiting. On admission the patient's temperature was 100°, pulse 70. The right side of the scrotum was filled with a tense tumor, the skin slightly red and oedematous, associated with tenderness. The cord, which extended into the external ring, was about the size of the patient's thumb (1.5 cm.). On coughing there was no impulse at the external ring or in the groin. There was a discharge of pus from the urethra, coverslips from which showed gonococci. The presence of this discharge the patient denied and in other ways his history was contradictory. A very careful examination of the tumor was made. In considering the large swelling in the scrotum, the very small mass extending into the external ring, and the absence of an impulse at the external ring or above, and of nausea or vomiting, it was thought that perhaps the patient was incorrect as re-

gards the history of a hernia and that the present condition might be an epididymitis following an acute urethritis. The patient was admitted on the afternoon of December 28, 1895; early the next morning he began to vomit and the pain in the tumor increased. Temperature 100.4°, pulse 76. No change in the condition of the swelling of the scrotum. It was considered best to explore at once. Operation 29-12-'95 (12 hours after admission), Bloodgood. After dividing the skin, the aponeurosis of the external oblique and internal oblique muscles, the transversalis fascia and the peritoneum above the internal ring, it was found that a loop of intestine descended towards the scrotum through the internal ring. The sac was then opened from the internal ring downwards toward the scrotum. The sac from the internal ring to 1 cm. below the external ring was very small, not more than 1.5 cm. in diameter. This portion of the sac measured 6 cm. in length and contained the ascending and descending limb of the loop of the intestines. Both pieces of gut were very much congested. The loop of the intestine extended about 2 cm. beyond the external ring. The remainder of the sac in the scrotum was distended with fluid. The base of the loop was the seat of distinct gangrene, but as yet no perforation. Four cm. of this loop were resected and an end-to-end suture after the method of Halsted was done. The sutured gut was returned, the opening into the peritoneal cavity closed with silk and the wound closed with silver wire, without transplantation of the cord. During the suture the general peritoneal cavity was protected by gauze sponges. Pulse at the end of the operation was 148; temperature 4 hours after operation was 104°, and 8 hours after operation 106°; pulse 160. The patient died eleven hours after operation. Autopsy 752: Acute general peritonitis; end-to-end intestinal suture, union solid, no leakage. Congestion and oedema of the lungs. Slight swelling of spleen, liver and kidneys. Acute epididymitis on the right side.

Case 3. Death from peritonitis after the reduction of a loop of strangulated intestine.

Surgical No. 4182. B. B., aet. 60; lumberman. Very large, right inguinal hernia; strangulated 72 hours, complete, acquired, indirect. The hernia had been present 40 years and patient had always worn a truss. Hernia became irreducible 72 hours before admission. The tumor was the seat of great pain and there was some nausea and vomiting. Pulse 95, temperature 100° on admission. General condition fair. Operation 5-5-'95, Nassau. Reduction of the intestines. Ligation and excision of a mass of omentum. Castration. Closure of the wound with 5 sutures of silver wire. The sac was opened at once; it was found to contain a loop of intestine about 15 cm. in length, very much congested and in some places quite dark; there was, however, no evidence of gangrene. The mass of omentum was also very much congested. The sac also contained a large amount of blood-stained serum, from which cultures were not taken. There were no adhesions between the intestines and the sac, and only old adhesions between the sac and the omentum. The omentum was ligated and excised. This required about 30 ligatures and consumed a good deal of time. The condition of the intestine appeared to be sufficiently good to allow it to remain in the abdominal cavity. The opening into the abdominal cavity was closed with silk. The remainder of the

sac was removed with the cord and testicle. Pulse at the end of operation was 120. Four hours after operation temperature rose to 102° (F.), pulse 124; 8 hours after operation temperature 104°, pulse 138; 10 hours after operation temperature 104°, pulse 130. Patient seemed quite comfortable. Patient died 36 hours after operation, having had a continuous temperature between 102° and 104° and a pulse varying from 120 to 130 until within two hours of death, when it suddenly became almost imperceptible and very rapid. Autopsy 660: Acute general peritonitis; streptococcus. Beginning gangrene of a small portion of the intestine (5 mm.), but no perforation. Congestion of the lungs.

**Case 4. Umbilical hernia; general peritonitis without gangrene.**

Surgical No. 3250. R. J. W., aet. 41; female, married. Very large, umbilical hernia; strangulated. Hernia of 4 years' duration, following heavy lifting. Strangulation 6 days. Patient in critical condition on admission. Temperature 103°, pulse 130. Operation 13-6-'94, Bloodgood. Incision of sac, reduction of intestine and omentum. Wound packed with gauze. Acute general plastic peritonitis present. Death 10 hours after operation. Autopsy: General peritonitis, oedema of lungs, chronic valvular disease of heart, double hydronephrosis and chronic nephritis.

**Case 5. Femoral hernia; resection and immediate end-to-end suture. Death, peritonitis.**

Surgical No. 1294. M. S., aet. 59; female, married. Small, right femoral hernia; strangulated, of 3 days' duration. 3 attempts at taxis have been made. General condition of the patient critical. Hernia of 1 year's duration. Has always been reducible until the present attack. Operation 17-11-'91, Halsted. Sac contained some clear yellow fluid and a Littré hernia. The strangulated portion was gangrenous. About 4 mm. of the intestine were resected and an intestinal suture, end-to-end, was made. The wound was left open and packed with a plug of iodoform gauze. Patient died on the 4th day. Temperature 103°. Autopsy No. 255: Streptococcus peritonitis and acute diphtheritic dysentery, chronic valvular disease of the heart and chronic nephritis. The suture was firm.

**Case 6. Femoral hernia; death, general peritonitis without gangrene of the intestine.**

Surgical No. 3100. B. G., aet. 55; female, widow. Small, right femoral hernia; strangulated. Patient was admitted to the hospital with a history of having had a reducible, femoral hernia for a number of years, which became irreducible 20 hours ago. On admission the patient had all the symptoms of general peritonitis, but the hernia was not present in the sac. Operation 23-5-'94, Finney. Laparotomy, exploratory. The femoral canal was patent, but contained no intestine. It admitted the index finger. In the ileum an area was found which showed evidence of recent constriction. A band of adhesions was also found between the omentum and the femoral ring. There was evidence of peritonitis, especially in the intestine above the constriction. Patient died in 36 hours, quite suddenly. No autopsy.

Case 7. Femoral hernia; resection; artificial anus. Death, exhaustion.

Surgical No. 4242. H. S., æt. 63, male, married; painter. Large, right femoral hernia. Strangulated 7 days. On admission patient was in wretched condition. Faecal vomiting. Operation 22-5-'95, Bloodgood. Excision of 45 cm. of gangrenous ileum and a large mass of gangrenous omentum. Artificial anus made. Wound packed with gauze. Patient in very bad condition after operation. Died in 3 days. No autopsy.

Case 8. Femoral hernia; resection and immediate end-to-end suture. Death.

Surgical No. 6788. Mrs. S. A. T., æt. 46 years. Medium, right femoral hernia; strangulated, gangrene of the intestine. In June, six weeks ago, patient was taken quite suddenly with vomiting and noticed for the first time a swelling in the right groin. It was irreducible for 24 hours. Three days before admission patient again began to suffer pain in the groin and noticed the reappearance of the tumor. It was tender and tense. Vomiting began almost at once. She became very weak. Vomiting has continued since. There has been complete constipation. She has been unable to take any nourishment and has not been fed by the rectum. Her physician attempted reduction a number of times and on one occasion injected carbolic acid (of unknown strength) into the sac. On admission the general appearance of the patient was fairly good; pulse, however, was 120 compressible; temperature 99.8°. The abdomen was somewhat distended and tympanitic; there was no tenderness or muscle spasm. The skin over the tumor was tender and oedematous. Operation 30-7-'97, Cushing; ether. Excision of about 4 cm. of small intestine, including the gangrenous portion; end-to-end suture. Excision and closure of sac; wound closed with silver wire. The operation was performed as follows: The mass was first isolated from the skin and surrounding tissue. Poupart's ligament and the constricting tissue about the neck of the sac were then divided; sac was then opened. It contained some fluid with faecal odor and a small coil of intestines, the size and appearance of the jejunum. An area of the intestines about 2.5 cm. in diameter (the size of a silver quarter of a dollar) was gangrenous. The circulation of the remainder of the loop which was constricted seemed good. The area of gangrene could be more easily explained by the carbolic acid injection than by the result of constriction. The area of gangrene with a good margin of healthy intestine were excised and an end-to-end intestinal suture was made after the Halsted method. The patient at the end of the operation was not in very good condition. Death took place 29 hours after operation. Following the operation there was a gradual rise of temperature from 100° to 107°. There were no abdominal symptoms, no distention, no vomiting. Some flatus and faecal matter passed per rectum. Nourishment given by mouth was retained. Blood cultures taken before death were negative. Autopsy No. 978: The union of the sutured gut was perfect; the intestines were not distended. There was no injection, no exudate. Cultures from the peritoneum showed a few colonies of colon bacilli.

Case 9. Femoral hernia; gangrenous loop brought out of wound; faecal fistula; secondary resection and end-to-end suture in two months. Third operation 15th day for obstruction; a second resection and suture. Death from peritonitis.

Surgical No. 7036. Mrs. A. W., æt. 61; housewife. Large, femoral hernia; strangulated. The hernia has been present 21 years. This is the first attack of strangulation. It began five hours before admission to the hospital, since which time she has been in intense agony, walking about the room with her body bent almost at right angles to the thighs. On being placed in bed her facial expression was that of pain but not of great depression. Pulse 82, respiration 24, temperature 97.4°. She complains of intense pain in the tumor. Nausea and vomiting have been present since the beginning of the attack. Vomitus is bile-stained; no faecal odor. The abdomen is soft, not distended, nor tender. The tumor in the left groin measures 15 x 15 cm. It lies directly over the inner two-thirds of Poupart's ligament, half above and half below the line between the pubic spine and anterior iliac spine. The skin is movable; no redness or oedema. The tumor is tense and slightly tympanic on percussion. Operation 17-10-'97, Bloodgood, one hour after admission. The incision was somewhat in the direction of Poupart's ligament, because from the examination it was difficult to tell whether it was an inguinal or a femoral hernia. Poupart's ligament and the aponeurosis in the external oblique above the tumor were first exposed and the external ring found. Having demonstrated the hernia to be in the femoral canal the sac was immediately opened into. Blood-stained fluid spurted out. (Cultures and coverslips from this fluid were negative.) Then a large loop of small intestine, the circulation of which was good; beneath this was a large mass of omentum, the circulation of which was also good. Situated in the outer side of the sac and on the outer side of the omentum and below the first loop of intestines was a second loop of intestine. This loop was caught behind a band of adhesions which extended between the sac and the omentum. This band was adherent to the sac about 2 cm. below its neck. It was the only adhesion between the omentum and the sac. The strangulated loop of intestines was black in color, the intestinal wall was soft, the line of demarcation between the dark area and the congested area was distinct; serum exuded from the congested area but not from the dark area; the mesentery of the dark area as well as of the congested area was full of areas of haemorrhage. The constricting band was cut. Poupart's ligament was then divided for a distance of 2½ cm. upwards and the tissue between Poupart's ligament and the sac was also divided. This made an opening large enough to reduce without difficulty the omentum and the loop of intestines whose circulation was not impaired. Waiting some 10 minutes after the relief of the constriction, no improvement was noticed in the circulation in the second loop of the intestine. Having decided not to return this loop into the abdominal cavity it was drawn out and the healthy portion of the intestine was sutured to the peritoneum. Bismuth gauze was then packed down to the sutures and the skin wound was partly closed. For 48 hours after the operation the patient had an excellent pulse, no rise of temperature, no nausea or vomiting. Nourishment was chiefly by rectum. At this time it was

noticed that there was beginning abdominal distention in the left iliac fossa and the patient began to be nauseated and vomited. With these indications an opening was made into the intestine and gas and faecal matter allowed to flow out. Immediately after this the abdominal distention disappeared and also the nausea and vomiting. November 1, 1897, 15 days after operation, the patient is making a rapid recovery. The wound is entirely closed about the sutured gut; a small area of the intestine has sloughed. Second operation 20-7-97, Halsted; ether (2 months after the operation for strangulated hernia). The fecal fistula and about 5 cm. of the intestine on each side were excised and an end-to-end suture performed, using the distended rubber bag in the method described by Dr. Halsted in the Philadelphia Medical Journal, vol. 1, No. 2, January, 1898. The external wound was closed without drainage. The dermatitis and the faecal fistula complicated the operation and no doubt were the cause of the infection of the wound. The patient was making an uneventful convalescence until the 14th day, at this time there was a rise of temperature to 102° (F.) and symptoms of obstruction. Exploratory laparotomy was performed the next day. The sutured intestine was adherent to closed wound, which was infected. In separating the bowel from its adhesions the suture was torn in one place. A resection and end-to-end suture after the same method was performed. Patient died 3 days later from general peritonitis. Cultures taken from the wound after the second operation, at the time of the third operation showed bacillus coli communis only.

Case 10. Inguinal hernia; loop of gangrenous ileum brought out of the wound; operation under cocaine. Second operation 28 hours; chloroform; resection and suture. Death third day, from pneumonia.

Surgical No. S392. William T., æt. 62; German, laborer. Admitted December 2, 1898, Friday, 6 P. M. Very large, right inguinal hernia, complete, acquired, direct, of 40 years' duration, since age 22. During these 40 years the hernia has never been larger than a hen's egg, and never descended into the scrotum until the present attack; always reducible, never painful. Ten years ago the truss was discarded, because it failed to keep the hernia reduced. Tuesday at 4 P. M. (3 days and 2 hours before admission), the hernia descended into the scrotum and has since remained irreducible. That night the patient did not sleep, and suffered a good deal of pain. Wednesday the tumor in the scrotum had increased in size and he vomited four times; since this time he has had continuous pain, and has vomited all food, and now and then when nothing was taken by the mouth. The bowels have not moved since day before hernia became irreducible. Micturition has been normal, no fever. His pulse has varied between 50 and 60. He has been given rectal enema on a number of occasions and yesterday Epsom salts and last night had 3 doses (hypodermically) of morphine, in all  $1\frac{1}{4}$  grains. He was brought to the hospital to-day in a carriage, being unable to walk. Examination on admission: Patient in bed; pulse 90, volume fair, soft, weak. Respirations about 30, a little jerky, almost entirely thoracic; tongue clean, abdomen soft, not distended, tympanitic on percussion, no peristaltic action noted.

The right scrotum is filled with a tumor, which extends up into the abdomen, through the external ring; there is no edema of skin or scrotum or abdomen. The entire tumor is fluctuating; also the part of tumor in the scrotum is less tense and more fluctuating, and at its apex one can distinctly feel the testicle; it is not tender. There is a slight constricture between the tumor in the scrotum and the second tumor, extending to the external ring. The second tumor is more tense and slightly tender, but not exquisitely so. One can palpate the iliac fossa quite deeply and can feel a small, rather firm sausage-shaped mass, perhaps two centimetres in diameter, communicating with the tumor outside the external ring; this mass is not tender. Patient's expression is one of pain and not one of peritonitis. Rectal temperature was 99.8°, leucocytosis 20,000. Operation at once, Bloodgood; cocaine. Morphine, grains  $\frac{1}{8}$  were given hypodermically and during the operation a second dose of  $\frac{1}{16}$  of a grain. The skin incision was injected with 2 dr. of a 1 per cent. cocaine solution and 3 dr. of boiled water. The skin incision gave no pain. Two veins were clamped and tied. The aponeurosis of the external oblique was divided, then the internal oblique muscle. The latter gave pain. It was seen at once that the hernia was of the direct variety. The peritoneum was then divided above the neck of the sac. On opening the peritoneal cavity one saw two pieces of intestine entering the external ring. The external ring did not appear to be much larger than the index finger, perhaps a centimetre and a half in diameter, and the loops of the small intestine were flattened out. There was no distention of either loop. A small, blunt periosteal elevator was passed into the sac from the peritoneal cavity and sac divided in a longitudinal direction. The wall of the sac was thick and the constriction was at the external ring. On opening the sac it contained blood-stained fluid (cultures sterile) and a loop of ileum about 12 cm. in length. This was drawn out and placed on wet salt sponges. The line of demarcation at the point of constriction was sharp, and the constriction of the intestine did not disappear. The loop of strangulated gut was almost black in color, the peritoneal surface was rough in some places; it was torn in a few places; there were small areas of a granular reddish appearance like a skin abrasion. The peristaltic action was noted once in the gangrenous portion, and after this observation the peristaltic action took place in the upper part of the ileum, but stopped at the point of constriction. The remainder of the sac was filled with a mass of omentum and about 100 cc. of blood-stained serum. Coverslips made from this at once showed only a few red-blood cells and leucocytes and no bacteria free or in the leucocytes; coverslip preparation from the gangrenous gut showed few leucocytes, but no bacteria. The omentum was ligated above the point of adhesions at the internal ring—the stump requiring about 20 ligatures. The gut, which had been during this part of the operation wrapped in hot salt sponges, was placed in the abdominal cavity, and the sac with its adherent omentum and the testicle was removed in one piece. The tunica vaginalis of the testicle contained about 50 cc. of clear fluid. The tissues about the testicle were very edematous. After removing this mass the intestine was again drawn out of the abdominal cavity. The line of demarcation, especially between the upper portion of the loop (stomach end) and gangrenous part, was very marked. The lower line of demarcation was less marked. There was no improvement to be noted in the circulation and there was no peristaltic action. The operator decided

that this portion of the gut could not be returned. It was considered best to leave the gut outside of the abdomen and wait for 24 hours. The healthy intestine at a point about 2 cm. from the line of demarcation was anchored to the peritoneum with 5 black silk sutures, so that the parietal peritoneum was approximated to the two loops of intestine. Bismuth gauze was then packed down to the line of suture, but not into the peritoneal cavity. The intestine was covered with protective and a mass of gauze held in place by a binder. The patient stood the operation pretty well. Full time about an hour and thirty-five minutes. The time-consuming part of operation was the ligation of the omentum and the removal of sac. The omentum could not have been reduced. The patient's pulse did not increase much in rapidity and remained about 90; respiration on a few occasions became 50 and pulse much softer.

December 3, 9 A. M., 14 hours after operation, pulse 78, respirations 24. The patient passed a fairly comfortable night, no nausea or vomiting. He has taken nourishment (about 4 ounces). Required only one-twelfth of a grain of morphia given at midnight. Highest temperature 100.6°. Highest pulse 90, respirations average 28. At 4.30 A. M. he complained of pain in the chest. On examining the chest it is slightly barrel-shaped; expiration is everywhere prolonged. Moist rales are to be heard all over the chest. Slight hyper-resonance. The second sound of heart is accentuated; no murmur, apex in place. Examination of wound: The loop of intestine which was covered with rubber protective is slightly distended; there is no peristaltic movement; it is, if anything, darker in color than at operation and in places the peritoneum seems to be absent and one sees a small area of red and black dots; there is a slight exudate of fibrin; cultures and coverslips sterile. The leucocytosis, which was 20,000 on admission, at 10 P. M. last night was 25,000, and at 6 and 8.30 A. M., 25,000. Second operation 12 (noon), 15 hours after the first, Blood-good; chloroform. Pulse at the beginning of anaesthetic was 86, in 10 minutes it rose to 100 and remained at about 100 during the operation. The chloroform was administered about 35 minutes. Complete time of operation was about 50 minutes. Patient took the anaesthetic well; no cyanosis, no nausea or vomiting. It was at first considered that the resection and suture might be done without an anaesthetic, but it was found that the wound was very tender, due perhaps to the peritoneal exudate and slight inflammation which must take place between the parietal peritoneum and intestine. The sutures between the intestine and the parietal peritoneum were rapidly cut and the adhesions between the intestine and parietal peritoneum were fresh and limited to the line of contact only; there was a little distention, but not much, of the small intestine. The mesentery of the intestine, corresponding to the loop brought out, was thickened by an exudate of serum and lymph; this made the ligation of the vessels difficult. There was no evidence of peritonitis. About 14 cm. of the intestine, including about 3 cm. above and below the area of strangulation, were excised. The mesenteric vessels were ligated quite close to the intestine and the operator was careful to preserve the blood-supply at the point of resection. When the intestine was excised a little faecal matter escaped. The ends were held out of the wound and washed with salt solution. The intestine was then approximated and a mattress suture of fine black silk placed and tied at each side of the mesenteric border, carefully approximating this part and seeing that the inversion was perfect.

The Halsted rubber bag was then introduced and two additional pre-section sutures tied. About 15 or 20 mattress sutures of fine black silk were necessary for suture, and after their introduction the bag was removed and they were rapidly tied; the approximation seemed perfect; no additional sutures were required. The mesentery was approximated with fine black silk. The circulation of the gut at the point of suture on both sides seemed perfect; peristaltic movement was not noted during operation. The resected and sutured loop was irrigated with salt, gently replaced in the abdominal cavity, which was then washed with normal salt solution (temperature 100°), about a litre was left in the abdominal cavity. The sutured loop was pushed upwards and to the left of the abdomen and it was then noticed that it did not return again towards the wound. This was done to prevent adhesions between it and the parietal peritoneum at the point of suture. The peritoneum was closed with a continuous suture of fine black silk and the divided tissue was approximated with four mattress sutures of silver wire, and the skin wound was closed. The condition of the patient at the end of the operation seemed excellent. The patient died at 2.35 A. M., December 6, two and one-half days after the second operation. During this time the symptoms were those of pneumonia. Highest temperature 100.6°, on the second day, respirations rapid, no cough or expectoration; there were no abdominal symptoms, abdomen was soft and not distended, bowels moved twice, flatus was passed, no difficulty of micturition, urine normal, nourishment well taken. There was hiccup once or twice, some nausea and a little vomiting—not more than usual after an anesthetic. Patient, however, was very restless after the first 36 hours, slightly delirious the last 24 hours, and for four hours before death was very cyanosed. Leucocytes remained about 18,000, dropping from 25,000. Urine acid 1028, slight amount of albumen and a few finely granular casts. Autopsy 1212, Dr. McCallum: Anatomical diagnosis: Operation wound, no evidence of infection, end-to-end suture of the small intestine, apparently perfect, slight localized peritonitis over the mesentery and about the resected intestine. Very extensive bronchial pneumonia; peritoneal cavity contained no excess of fluid. Intestines were slightly distended, but this was no evidence of a general peritonitis. The loop of intestine at the position of the suture and its corresponding mesentery were covered with a slight exudate and a very little bloody fluid. This loop of intestine and its mesentery were in the pelvis and the sutured loop was very slightly adherent to the adjacent loop of intestine. Adhesions were easily separated. The condition of the mesentery corresponding to the loop of intestine is thickened and oedematous, a condition noted at the operation, which did not seem to have increased. Cover-slips showed a few leucocytes and red-blood cells and very few bacilli and cultures, a few colonies of colon bacilli. The lungs are the seat of an extensive bronchial pneumonia.

Case 11. Inguinal hernia; resection and immediate end-to-end suture. Recovery (see Group II, Case 23).

## GROUP XII. IRREDUCIBLE INGUINAL HERNIA IN WHICH A RADICAL OPERATION COULD NOT BE PERFORMED. 4 CASES.

## Case 1.

Surgical No. 628. T. Y., aet. 52. Very large, right inguinal hernia; irreducible. Hernia of 8 years' duration and slow formation, following an injury in the groin. The hernia descends into the scrotum and is not completely reducible. Patient wears a truss, which gives a great deal of discomfort, and he is almost incapacitated for work. Operation 17-9-90, Halsted. Incision of the skin; opening of the sac. Sac contained intestines and a large mass of omentum, which were adherent to each other and to the neck of the sac. Reduction was impossible and a radical operation could only have been performed after resection of the large mass of intestine; for this reason the wound was closed without any attempt at a radical operation. Healing p. p. Highest temperature 101°. No improvement followed the operation.

## Case 2.

Surgical No. 1916. J. B., aet. 74; German. Large, right inguinal hernia; strangulated, complete, acquired, indirect, of 2 years' duration. The hernia had been irreducible for some weeks. For the last 5 weeks the patient has had pain in the abdomen, associated with vomiting. He was unable to give a very clear history of his condition. Operation 14-11-92, Baltzell. It was found that the sac contained intestines, which were adherent at every point, and during the dissection the intestine was opened. It was impossible to demonstrate the presence of any obstruction or strangulation. An artificial anus was made. Patient died in 24 hours. Following the operation there was a rapid rise of temperature, rapid pulse and respiration. No autopsy.

## Case 3.

Surgical No. 3303. H. S., aet. 67, bookkeeper. Very large, right inguinal hernia; irreducible, complete, acquired, indirect. Hernia of 20 years' duration, following heavy lifting. Patient has had three attacks in which the hernia has been strangulated. It has been present in the scrotum and irreducible for 2 years. 24 hours before admission he began to have pain in the situation of the hernia, associated with nausea and vomiting. Operation 1-8-94, Werckmeister. Incision of the skin and the aponeurosis of the external oblique and the scar tissue about the internal ring, relieving the constriction. In making an exploratory incision into the sac, the intestine was so intimately adherent that it was opened. The opening was sutured and the wound closed without any attempt at a radical operation. The wound broke down on the 10th day and there was a faecal fistula for some weeks. Patient was discharged in 11 weeks, the wound having completely healed. Patient lost track of since.

## Case 4.

Surgical No. 5722. Male, aged 50 years. Very large, right inguinal hernia; irreducible, complete. The complete history of this case has

been lost. Patient had had a large irreducible hernia for a number of years. Symptoms of strangulation had been present a number of hours before admission. Admitted to hospital in a very critical condition. Operation 10-8-'96, Finney; ether. On opening the sac it was found to contain a number of loops of intestine which were so adherent to the sac in every direction that the reduction would have been impossible. The symptoms of strangulation were due to an additional loop which had been caught at the internal ring and had descended into the lumen of the sac only about 2 cm. This loop of intestine was gangrenous but had not yet perforated. Neck of the sac and the peritoneum above were divided, releasing the loop of gangrenous intestine, which was drawn out of wound and held in place by gauze. Patient died a few hours after operation. Autopsy No. 837: General fibrinous peritonitis, acute bronchitis; congestion and oedema of the lungs, with emphysema and chronic diffuse nephritis. (See photograph No. 5.)

#### GROUP XIII. ODD CASES 1, 2, 3, 4.

##### Case 1.

Surgical No. 1579. M. J., aet. 5; colored girl. Large, umbilical hernia; not completely reducible. Operation 13-5-'92, Halsted. On opening the sac a mass of intestines was found, adherent to each other and to the sac. On breaking up the adhesions the intestine was injured in two places, the first situated in the small intestine, the second in the transverse colon. From the small intestine 8 cm. was excised and an end-to-end intestinal suture made. From the large intestine 5 cm. were excised and a similar suture made, after which the operator was able to reduce the intestines and close the wound with buried silk. Patient died on the 7th day with symptoms of peritonitis. Autopsy: Acute purulent peritonitis was found, also tuberculosis of the intestine, of the mucous membrane and the peritoneum, and of the mesentery glands.

##### Case 2.

Surgical No. 2675. J. P., aged 35. *Chronic obstruction of the bowels following an operation for strangulated hernia.* Hernia of 12 years' duration, following heavy lifting. In August 1893, 3½ months before admission, patient states that he was operated on because the hernia was strangulated. He does not know what operation was done nor what was found. He states that the wound healed without suppuration and there is a linear scar in the right groin. He has never recovered from the operation, but he has suffered continually with pains in the abdomen; the bowels have been constipated, but there has been no vomiting. The abdomen has never been greatly distended. He has lost a great deal of flesh. Patient states that these pains are paroxysmal in character and he has noticed during the attack of pain the peristaltic movements of the intestines. Examination: The patient is emaciated and seems to be in almost constant pain. He has taken a good deal of morphine and is constantly crying for a hypodermic injection. The abdomen is not distended, but at intervals coincident with the sharp attacks of pain peristaltic action of the small intestine is easily to be made out. The movement seems to

end at the outer border of the right rectus muscle, about midway between umbilicus and ensiform. At this point there is an area of about 4 x 4 cm. in which the abdominal wall is indurated and tender. It is slightly dull on percussion. The tumorous mass is not movable, but fixed to the abdominal wall. There is no dilatation of the stomach. In the right groin there is a scar 10 cm. in length and 4 mm. in width. Operation 1-12-'95, Halsted; ether. An incision was made through the rectus muscle over the area of induration and opening at once a small abscess cavity which contained pus with a faecal odor. The floor of the abscess was formed by coils of intestine adherent to each other. From the surface of one loop of intestine mucous membrane was seen and an opening was found which admitted the index finger; nothing further was done. The wound was left open. Patient died 27 days after operation, of exhaustion. No autopsy was allowed. Following the operation, although the greatest care was taken to cleanse the wound, the discharge of faecal matter produced an extensive dermatitis, which covered almost the entire abdomen. The pain was not relieved; the excessive peristalsis of the intestine remained about the same. The temperature was slightly subnormal, the highest being 100° (F.), a few days after operation. Pulse varied from 100 to 130. During the last few days of life he was unable to take nourishment by the mouth and was fed by nutritive enema.

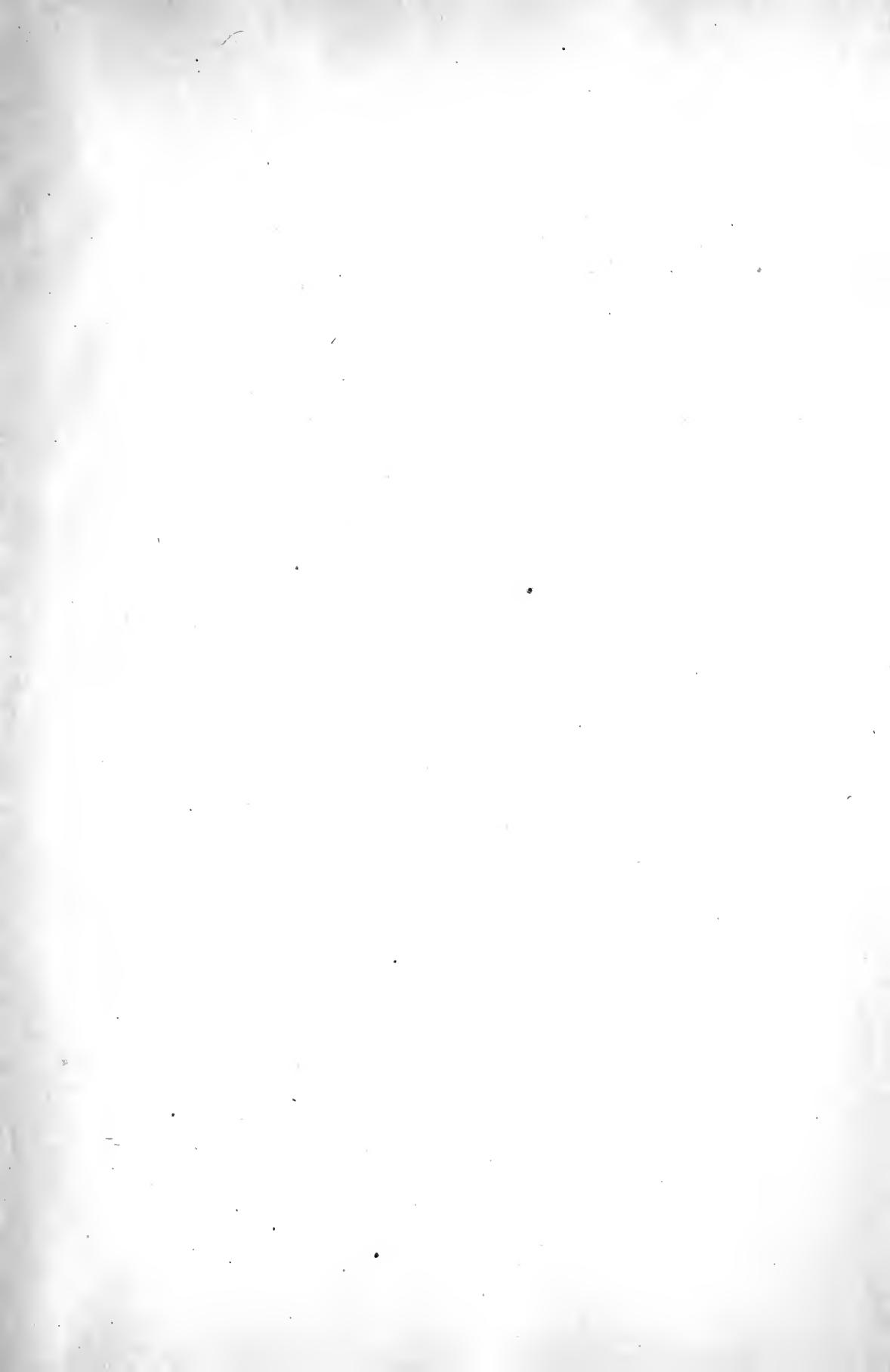
### Case 3.

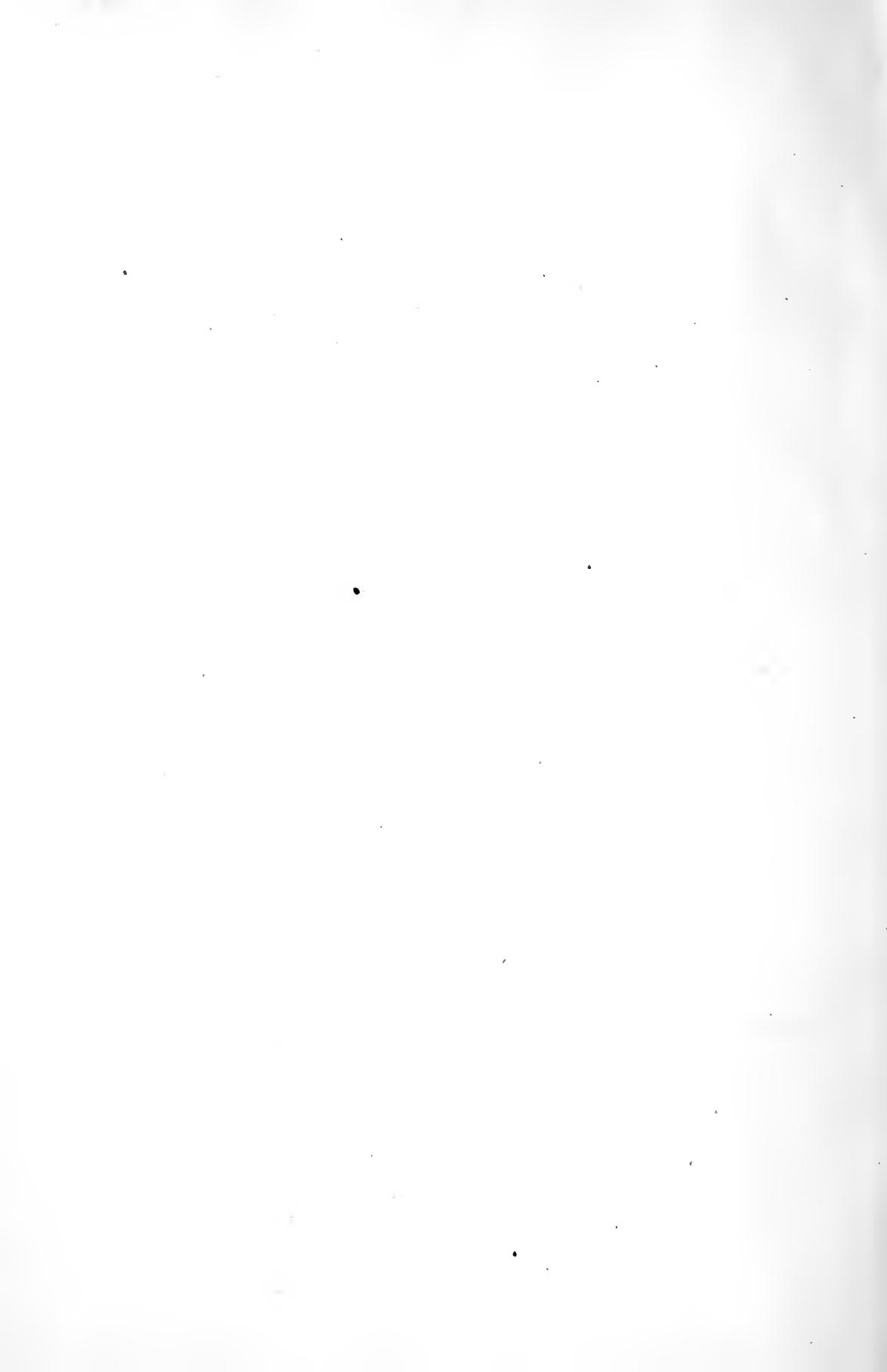
Surgical No. 4757. W. R., aged 46; laborer. *Acute obstruction of the bowels; cause, strangulation of a hernia reduced "en bloc."* Two weeks before admission patient was taken suddenly with abdominal pain followed by nausea and vomiting, lasting a few hours. Three days before admission he was taken suddenly with a second attack; abdominal pain, nausea and vomiting, which has continued with very little intermission. We could obtain no history from the patient of the presence of a hernia in the left groin. Patient was admitted October 25 at one P. M. His condition was critical; pulse 150, very weak; respirations 50, much cyanosis. The abdominal examination was negative. There was no pain, no tenderness and very little distention. No tumor could be made out. In the afternoon an enema was given, which was followed by the passage of some faecal matter but no flatus. During the night the patient complained of no pain. The pulse improved slightly, the rate falling to 120. The rapid respirations and cyanotic appearance continued. The facial expression was one of extreme depression. Examination of the abdomen and rectum negative. Urine was passed without difficulty. Vomiting took place at frequent intervals and consisted of 3-4 ounces of dark fluid which had a faecal odor. The patient was not restless nor anxious. Both external rings were examined; nothing could be made out. October 26, 20 hours after admission, it was considered best to perform exploratory laparotomy. On opening the abdomen dilated coils of small intestine came into view. Some of the coils were adherent by non-vascular fibrous tissue, demonstrating that the adhesions were of long duration. There was evidence of a general peritonitis, the intestines were injected and there was covering the peritoneum a slight exudate. No fibrin, no pus. Patient died 14 hours after operation with a temperature of 103.2°. Two hours before death pulse was 160; respiration 60. He complained of no pain; he was

not restless and the abdomen did not become distended. On opening the abdomen at the autopsy coils of small intestine were found to be adherent to each other and to the abdominal wound by fresh adhesions. Covering the peritoneum was a viscid red material. The large intestines were collapsed and the lower third of the ileum was also collapsed. The remainder of the small intestines was distended, but not greatly. In the left inguinal region, extending somewhat into the pelvis, was a mass extending into the peritoneal cavity and covered by peritoneum. Into this mass the small intestines extended through an opening about  $2\frac{1}{2}$  cm. in diameter. These loops of intestine lay in a cavity, beyond the opening, lined by peritoneum which was continuous with the parietal peritoneum of the abdominal cavity. The opening no doubt corresponded to the neck of an inguinal hernia and the cavity containing the intestines to the sac of an inguinal hernia which had been reduced *en bloc*. The coils of intestine contained in the sac were dark black in color, but as yet there was no evidence of gangrene, and the intestines were not adherent. There was no fluid. The hernial sac did not extend into the inguinal canal. There seemed to be no other explanation but that of a left inguinal hernia which had been reduced *en bloc*, and there had been some strangulation of the coils of the intestine in the sac, resulting in a general peritonitis without gangrene of the intestines.

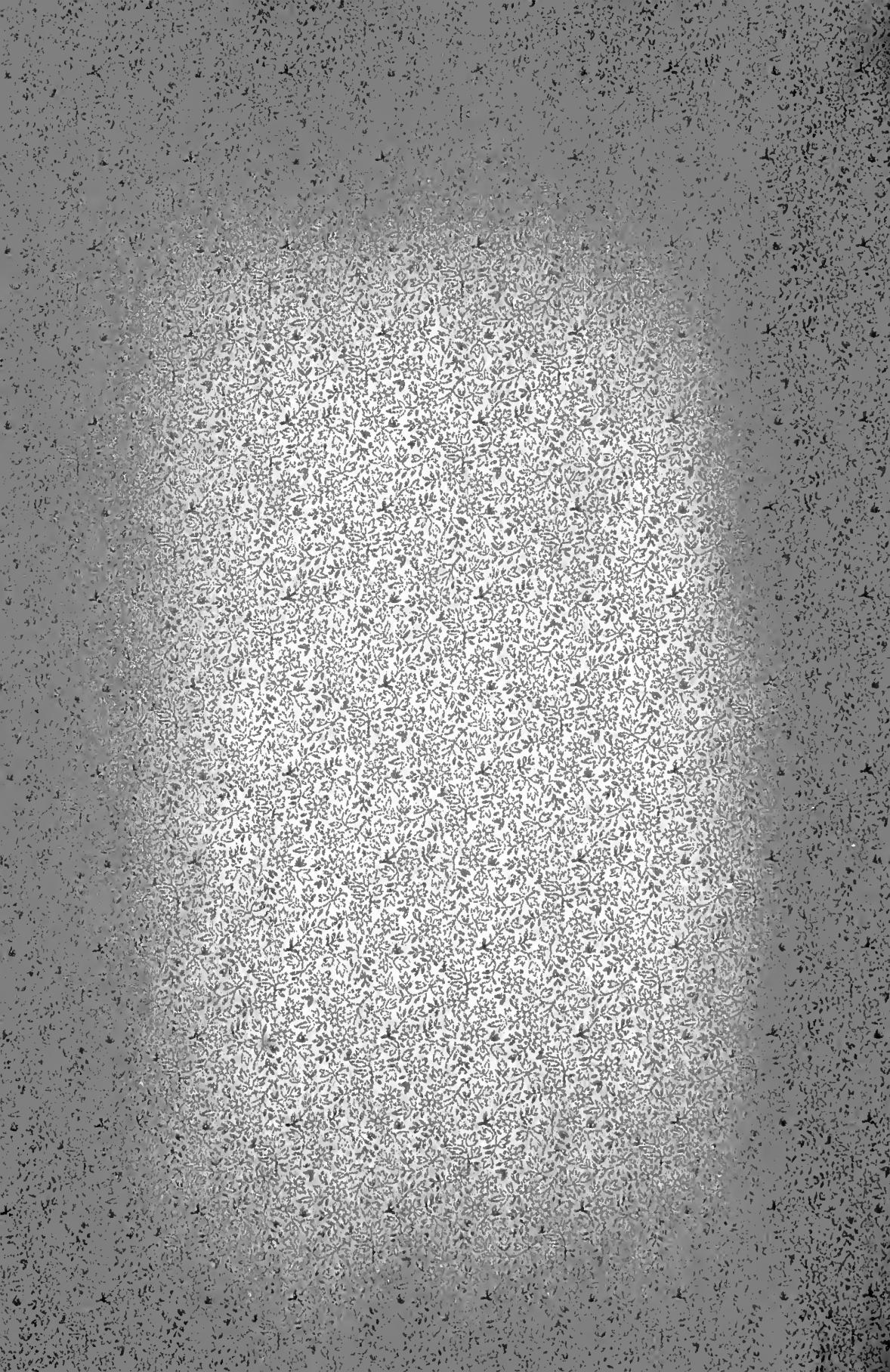
#### Case 4.

Surgical No. 6851. H. M., male, aged 51 years. Very large, left inguinal hernia; complete, acquired, indirect. Strangulated 22 hours. Patient's condition on admission was so critical that a complete history could not be taken. He had had the hernia for 15 years and wore a truss. The hernia became irreducible and there were symptoms of strangulation 22 hours before admission, and there had been one unsuccessful attempt at taxis. Operation 20-8-97, Cushing; ether. Patient took the anaesthetic very badly, became cyanosed at once, and died before the sac was opened. Autopsy No. 985: The seat of the strangulation was about 7 cm. from the cæcum and 4 cm. from ilium, was congested and covered with fibrum. No evidence of necrosis. No general peritonitis. Cultures from general peritoneal cavity, negative. Both testicles showed evidence of syphilitic orchitis. There was a gumma in the cerebellum. We learned later from his physician—who, however, did not accompany him to the hospital—that the patient had been blind for some time and was an old syphilitic.









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